ANNALS *of* SURGERY

VOL. LXI MARCH, 1915 No. 3

# TONSILLECTOMY IN CHILDREN FROM THE STAND-POINT OF THE GENERAL SURGEON*

BY DONALD C. BALFOUR, M.D.

OF ROCHESTER, MINN.

(Mayo Clinic)

THE surgeon whose work is not restricted to a special field is frequently called upon to remove tonsils. Unfortunately with the laity, and too often with the surgeon also, there is a tendency to look upon this operation with more or less indifference and with a feeling that it is a comparatively simple one. Undoubtedly as the operation was carried out formerly, and, to a less extent, at the present time, it could be considered free of any technical difficulty, but this very simplicity was often the indirect cause of an incomplete operation and an unsatisfactory result. Attention has been drawn repeatedly to the fact that many children who supposedly had their tonsils removed have either failed to obtain relief for the symptoms for which they were operated on, or have later in life developed local or constitutional disturbances from hypertrophied stumps of tonsillar tissue.

In spite of considerable uncertainty as to the exact function of the normal tonsil and of much protest both in the lay and medical press against the so-called "slaughter of the tonsil," it is true that diseased tonsils are often the source of ill health both in children and adults. To what extent the tonsil should be held responsible for various forms of arthritis, lesions of the gastro-intestinal tract, infections of the gall-bladder, tuberculosis, exophthalmic goitre, etc., remains to be elucidated by those who are investigating the subject. The work of Rosenow is particularly suggestive and promises important knowledge along this line. Inasmuch as such strong differences of opinion exist as to the rôle the tonsil plays in various conditions of obscure etiology, one should exercise careful judgment as to the necessity or advisability of tonsillectomy.

* Presented for publication December 2, 1914.

Without entering into a detailed discussion of the indications for the removal of the tonsils, it seems logical surgically that if the tonsils are visibly diseased or obstructively enlarged, or if they can reasonably be considered the atrium of infection for some local or constitutional disturbance, both glands should be entirely removed. While tonsillectomy is now rather generally advocated as the operation of choice, yet it is not consistently carried out. For instance, statistics from the New York public schools, where investigation of the condition of the throat following tonsil operations was made, show that in 10 per cent. of the children there had been mutilations of the soft parts surrounding the tonsil; of those operated on without general anæsthesia, 90 per cent. of the operations were badly done, and of those operated on under general anæsthesia, 25 per cent. of the operations were badly done.

Assuming in a given case that the advisability of tonsillectomy is apparent, what method should the general surgeon adopt if he is to do a complete and effective operation? Numberless instruments are offered to make the operation easy. Practically all of these are based on the guillotine principle and are modifications of it. It is significant that the surgeons of greatest experience with these instruments admit a varying percentage of cases in which the instrument could not be used or failed to remove the entire tonsil, necessitating resort to dissection to complete the operation. It is therefore true that dissection properly performed will accomplish tonsillectomy in 100 per cent. of cases, while any of the modified guillotine operations will prove inefficient in a varying percentage of cases.

Dissection cannot be advocated as a uniformly easy method for tonsillectomy varies in difficulty just as do most surgical procedures. In difficult cases the operation, if properly carried out, that is, without damaging trauma to the faucial pillars or other surrounding soft parts and without risk of hemorrhage, infection, etc., cannot be classed as a "minor" one. Further, statistics show that the operation is not devoid of these serious complications, or even of mortality. It thus seems incumbent to select some method which is safe as well as adequate.

The importance of an anæsthetic administered by one who is accustomed to inducing the particular anæsthesia which is desired in these cases is quite evident. Failure in this regard is often the cause not only of unsatisfactory operations, but of other disastrous consequences. The child must be thoroughly asleep so that unabolished reflexes will not interfere with the dissection; but the depth of anæsthesia should not exceed a point which is just commensurate with the average length of time necessary for the removal of the tonsils. It is not objec-

FIG. 1.—Finger behind posterior pillar elevating tonsil.

FIG. 2.—Anterior pillar separated and pushed from capsule of tonsil.

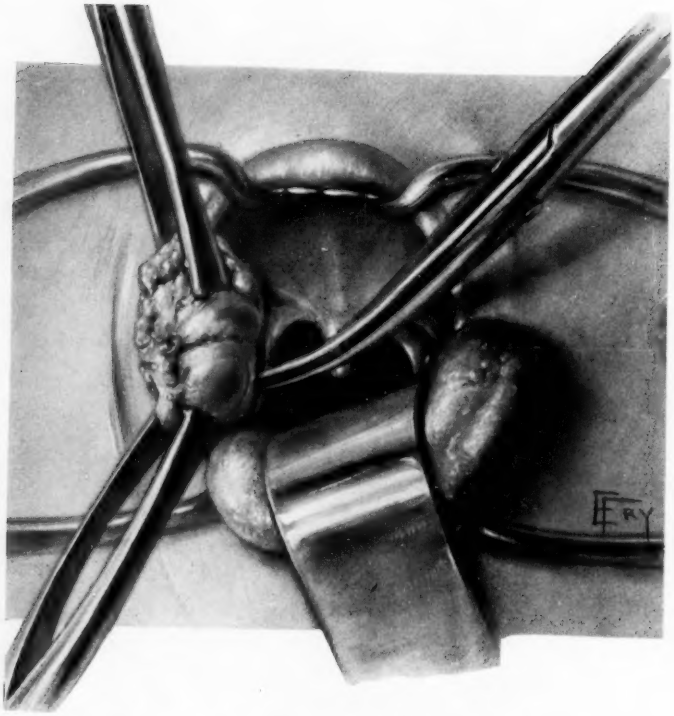


FIG. 3.—Tonsil turned and dissection completed by separating posterior pillar.

tionable for the child to show signs of returning consciousness when the first tonsil has been removed. More ether can then be administered, while a little pressure with the gauze-covered finger may be advantageously applied to the recess from which the tonsil has been removed. The ideal anæsthesia is one which is sufficient for the operation yet light enough so that the patient is already returning to consciousness by the time the operation is completed.

Dissection offers the least liability to primary or secondary bleeding. In this regard lies one of the most important advantages which the dissection method possesses. In only one case has hemorrhage been seen in the cases operated on by this method which caused any concern and that was readily controlled by suture. The absence of bleeding is due mainly to the fact that removal of the entire tonsil permits the tonsillar vessels to retract into the muscular wall of the pharynx. The slight hemorrhage differs strikingly from that which often occurs from the tonsillar stump following tonsillotomy.

As to the special technic of the operation, there is much less to be said than to be acquired. A modification of the Waugh method was introduced into the Mayo Clinic some four or five years ago by Beckman. It has proved satisfactory in the 1654 cases which were operated on under anæsthesia from January 1, 1909, to December 1, 1914.

Good anæsthesia is the first essential. The position of the child should conform to the individual preference of the operator. We prefer the child lying with the head free over the head of the table, which should be slightly lowered. The child's head is supported by the hands of an assistant who stands at one side of the table. On the opposite side is an assistant who aids by traction of the tongue, sponging, etc., while the operator stands at the head of the child between the two assistants.

A Whitehead mouth gag without the tongue depressor is fixed in place. The operator's index finger is introduced behind the posterior pillar of the tonsil, and by firm upward traction of the tonsil the anterior pillar is put on the stretch. With blunt dissecting scissors or tissue forceps the pillar is then well freed from the anterior surface of the tonsil, care being taken not to break through the capsule of the tonsil. This enables the operator, by means of the supporting finger behind, to force the tonsil well forward and to securely engage the tonsil with a tenaculum (Fig. 1). Ordinary uterine tenacula, although they have a tendency to tear into a soft, friable tonsil, when carefully manipulated are very satisfactory for this purpose.

The tonsil, firmly held, is turned over, so to speak, to expose

the posterior pillar, and this is freed usually by blunt dissection (Fig. 2). The superior pole is now enucleated from the superior tonsillar fossa and, in the majority of cases, the tonsil may then be rolled out of its bed without any more than blunt dissection. In very adherent glands one proceeds, first well separating the pillars, following by blunt dissection where possible, or by careful clipping with the dissecting scissors, until the tonsil is entirely freed from the pharyngeal wall.

This method enables the operator to actually see what he is doing, and, for this reason particularly, possesses distinct advantages as a precise and safe operation in the hands of the competent general surgeon who has acquired the technic and who appreciates the fact that the operation demands skill, care and experience.

# MECHANISM OF THE PRODUCTION OF HEMORRHAGIC EROSIONS OF THE ŒSOPHAGUS AND OF SOME ASSOCIATED LESIONS IN ILEUS*

By Benjamin F. Davis, M.D.

of Chicago

Nicholas Senn Fellow in Surgery, Rush Medical College

(From the Laboratories of Pathology and of Surgery of Rush Medical College.)

Hemorrhagic erosions of the œsophagus are among the rarities in the literature of pathology. Three cases are mentioned by Meyer [1] as occurring in infants with malæna neonatorum and Kaufmann [2] reports the occurrence of the lesions in a girl of twenty who died from the effects of a severe burn. Diligent search through the available literature has failed to reveal further examples.

According to Kaufmann hemorrhagic erosions appear in the lower portion of the œsophagus as sharply circumscribed patches, from a fraction of a millimetre to a centimetre or more in diameter, more or less oval in outline, sometimes arranged in series, brownish, superficial or invading the submucosa, and often in great numbers. The surrounding mucosa may be undermined.

Kaufmann believes that hemorrhagic erosions in the œsophagus may arise through the same agencies that are responsible for their production in the gastric mucosa. When small mucous or submucous gastric hemorrhages undergo partial digestion by the gastric juice, so that there results a loss of substance, they become the so-called hemorrhagic erosions. Such small hemorrhages are usually due to passive hyperæmia, as in heart disease, cirrhosis of the liver, pulmonary emphysema and excessive vomiting. Not rarely they are agonal lesions. They may become confluent, and form large irregular blotches from which fatal hemorrhage sometimes occurs; they may follow as the result of severe infectious diseases; of the hemorrhagic diathesis; of the action of endogenous poisons as in uræmia and cholæmia; or of exogenous poisons as phosphorus, arsenic, mercuric chloride, acids and alkalies. They may be embolic as in endocarditis, pneumococcæmia or streptococcus sore throat. Experimentally and clinically lesions of the central nervous system and of the suprarenals [3] have been causally associated with gastric hemorrhages. The latter have also been described in hysteria and as an expression of vicarious menstruation.

Gastric and duodenal hemorrhages (very rarely œsophageal) appear-

* Reported at the Chicago Pathological Society, October, 1914.

ing in the first few days or week of life, and sometimes leading to ulceration, may be due to brain lesions following birth injury, or to embolic vascular occlusion following thrombosis in the umbilical vein with either crossed (ductus Botalli) or retrograde venous embolism.

Of great clinical interest are the post-operative gastric and intestinal hemorrhages which follow laparotomies especially, and more especially those in which omental vessels have been ligated.[4] They result from direct and retrograde thrombosis in the arterial as well as in the venous system. Such thrombi frequently are septic. The hemorrhages appear once or more, usually in the first week, and the pathological changes consist of hemorrhages, erosions and ulcerations. In appendicitis similar changes arise through retrograde embolism, the emboli coming from the omentum, appendix or mesenteriolum. Payr[5] has produced gastric hemorrhages, erosions and ulcers through retrograde embolisms in the portal system; Friedmann and Hamburger[6] and others by direct embolism, and Rosenow[7] by the intravenous injection of streptococci of a certain grade of virulence and with a marked affinity for gastric tissue.

Excessive vomiting is said to cause gastric hemorrhages through the marked venous hyperæmia resulting on the crests of the folds of mucosa which are thrown up when the volume of the stomach is much reduced under pressure. The hyperæmia would be particularly noticeable in case the act of vomiting were associated with extreme and prolonged contraction of the gastric musculature. Œsophageal hemorrhages as a result of vomiting appear to be relatively rare, though Schultz[8] describes two fatalities from this complication. The lesion in each of these patients, who were in the midst of an alcoholic debauch at the time the accidents happened, consisted of two linear tears in the mucosa at the cardiac orifice in one, and at about the level of the cricoid cartilage in the other. The tears, as seen at autopsy, were quite fresh, 2 or 3 cm. in length, about 5 mm. in width, tapering to an acute angle at each end. There were no varicosities, foreign bodies nor history of instrumentation.

In ileus, hemorrhagic erosions of the œsophagus and stomach may be due to any one of the causes of mucous and submucous extravasations mentioned in the preceding paragraphs. The evidence in the case to be described, however, seems to offer an explanation of their occurrence which has not been advanced heretofore and which may become worthy of consideration in connection with the operative treatment of intestinal obstruction, and with the theory of the relation between toxin production by the intestinal mucosa and death from ileus.

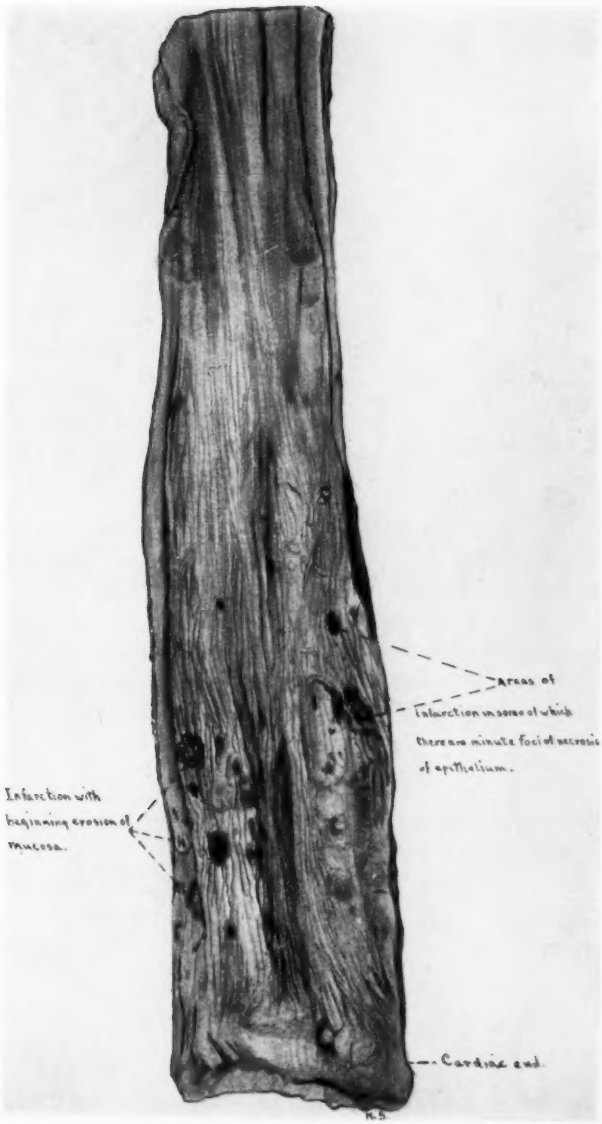



FIG. 1.—Lower nineteen centimetres of œsophagus (three-fourths natural size) showing areas of thrombosis, infarction and hemorrhagic erosion.

In November, 1911, Dr. E. Wyllys Andrews operated upon a man for intestinal obstruction of three days' duration at the Cook County Hospital. At the operation the obstruction was found due to a band of adhesions about three inches above the ileocecal junction; a beginning peritonitis was also found. The intestine proximal to the obstruction was markedly distended, and distally collapsed. The bowel was drained of its contents through an incision which was later closed with a purse-string suture, and an ileocolostomy was done. The patient died a few hours after the operation. At a post-mortem examination, made by Dr. LeCount, the following anatomic diagnosis was made: acute serofibrinous peritonitis; laparotomy wound (recently made); enterocolostomy; sutured hole in the small bowel; multiple regions of infarction of the small bowel and mesentery due to thrombosis of the mesenteric veins; dilatation of the small bowel; empty colon; large region of red infarction of the liver (Zahn); multiple regions of thrombosis, hemorrhagic infarction and ulceration in the œsophagus; marked senile sclerosis of the aorta with atheromatous ulcers and adherent fibrinous masses; healed infarct of left kidney; marked cloudy swelling and fatty changes in both kidneys; bilateral fibrous pleuritis; marked anthracosis and senile emphysema of the lungs; undescended cæcum; hemorrhages into the gastric mucosa.

Of these alterations there are several deserving special attention. First, the dilatation of the small bowel—this was extreme at the time of operation, was relieved by enterostomy, and was again quite marked at autopsy. Second, the areas of thrombosis, infarction and hemorrhage in the mesentery and small intestine—the infarcts about six in number were distributed along the course of the bowel, chiefly in the jejunum, opposite the mesenteric attachment, as bluish elevations of the mucosa varying in size from that of a silver dollar to oval lesions four inches in length; in the central portion of some were narrow slit-like tears in the mucosa about an inch long; the contents of the bowel were bloody. Third, hemorrhages into the gastric mucosa—these were multiple, varying in size from a millimetre or two to that of a silver dime. Fourth, multiple areas of thrombosis, hemorrhagic infarction and ulceration in the œsophagus—these lesions were limited to a circular band in the upper three-fourths of the lower one-third of the œsophagus; they were approximately circular in outline and varied from 1 to 10 mm. in diameter; in the fresh specimen, minute areas of necrosis of the mucosa were visible over the infarcts, but there was no post-mortem digestion; some of the lesions appeared recent with unbroken mucosa, while others seemed older, were brownish-black and

were the ones in which the minute areas of necrosis appeared; these lesions were essentially hemorrhagic erosions of the œsophagus. Fifth, a large region of atrophic, red infarction (Zahn) of the liver.

Microscopic study of the œsophageal and mesenteric lesions confirms in full the diagnosis of thrombosis, infarction and hemorrhage as made at autopsy.

Gastric distention, as has been shown by Burton-Opitz,[9] may produce complete obstruction of the gastric circulation. Working on dogs it was found that air forced into the stomach squeezed the blood out of the vessels and flattened them, damming back the blood on the arterial side. If considerable pressure (30–50 mm. Hg) were somewhat quickly applied, there resulted a sudden rise of venous pressure which was succeeded by a rapid fall, to rise again only when the intragastric pressure was relieved. An intragastric pressure of 50 mm. Hg was always sufficient to stop the flow of blood through the intramural vessels of the stomach. Increased intra-abdominal pressure up to 70 mm. Hg may likewise stop the portal circulation which may be restored by removal of the pressure.

The normal intragastric pressure in man varies between 6 to 19 and 20 to 162 cm. of water in the cardiac and pyloric ends of the stomach respectively. In the dog the normal intragastric pressures are approximately the same as those in man. Pressures may rise much above these figures in portions of intestine cephalad to a point of obstruction. Richards and Ruggles [10] fastened a recording apparatus in the intestine of a cat and found that the pressure in the obstructed region varied between 60 and 120 mm.Hg, and that when ergot and physostigmin were given these figures were greatly exceeded—pressures amply sufficient to cause complete arrest of the circulation in the portion of bowel involved.

From the stand-point of pathological anatomy, it is recognized that intestinal distention may lead to anæmia of the bowel wall with stasis and thrombosis in the mesenteric blood-vessels, leading occasionally to necrosis of the mucosa with the formation of so-called "dilatation ulcers." [11] The order in which this train of lesions develops is described as follows: "intestinal distention, venous stasis; thrombosis, hemorrhage, necrosis, ulceration." The importance of the rôle of vasomotor paralysis and of the toxicity of infectiousness of the intestinal contents in the production of dilatation ulcers is uncertain. Experimentally where the presence of powerful toxins has been demonstrated, not only in intestinal contents but also in the intestinal mucosa, submucous hemorrhages with ulceration occur frequently but not invariably.[12] When they do occur there is always an associated intestinal distention, thus

making it appear that the latter may be the important factor in their production.

In an obstructed bowel, interference with the circulation probably develops as follows: The segment of bowel immediately cephalad to the obstruction is thrown into violent peristaltic contraction, increasing intra-intestinal pressure tremendously and squeezing most of the blood out of the intestinal capillaries. The peristaltic contractions increase in number and duration, in some cases developing into a tonic spasm of entire loops. Gradually exhaustion of the intestinal musculature thus devascularized makes its appearance, and the bowel slowly yields to the pressure of the contained secretions and gas, finally ballooning out to form, in the earlier stages, the areas of regional distention (known clinically as von Wahl's sign), and later the general tympanites of ileus. As the increased intra-intestinal pressure from muscular contraction closed the intramural capillaries of the bowel in the first instance, so the pressure of the intestinal contents and the stretching and flattening of the capillaries in the distended portion tend to maintain that closure in the second. Thrombosis from stagnation is one of the results.

In the present case conditions seem to have been about as follows: There was first marked increased intra-intestinal pressure. This caused collapse and occlusion of the thin-walled vessels in the intestinal wall, with resulting stasis in the mesenteric vessels, in many of which thrombi presently formed. Meanwhile, with approximately the entire circulation through the small intestine shut off, the flow of blood through the portal vein became much reduced in volume, and, as a result, the rate of flow through the fine venous radicles in the gastro-œsophageal anastomosis, never very rapid, probably, under normal conditions, practically ceased and thrombosis from stagnation occurred. At the operation the distention of the bowel was suddenly relieved; there was a sudden influx of blood into the portal system with almost explosive hemorrhagic infarction of the more extensively thrombosed areas in the intestines, with occasional rupture of the mucosa and escape of blood into the bowel lumen, and the more gradual infiltration of the thrombosed areas in the œsophagus. Simultaneously, many of the small thrombi in the mesenteric vessels were swept out into the portal vein and carried to the liver, there producing extensive infarction.

Hartwell and Hoguet [13] and Gurd [14] have suggested upon the basis of experimental work that the powerful poisons described by Whipple [12] and his associates in the contents and in the mucosa of closed intestinal loops are the results of tissue autolysis. It is universally agreed that

the prognosis in intestinal obstruction from any cause becomes doubly serious the moment that vascular injury develops. Tissue autolysis follows as a result of vascular injury. The manner in which increased intra-intestinal pressure may produce vascular injury has been discussed in the preceding paragraph. Therefore the suggestion that increased intra-intestinal pressure may be of primary importance in determining the onset of intoxication demands consideration. Experimentally there seems to be no doubt but that loss of water is of extreme importance in producing the early symptoms of collapse in ileus and that, given sufficient water to replace that lost in the vomitus, urine, etc., a dog's life is not immediately imperilled.[13] He suffers from starvation. His metabolism becomes that of a starving animal—unless vascular injury is produced, when the occurrence of death becomes but a matter of hours.

The complications or sequelæ of intestinal obstruction appear to be intimately related to local vascular alterations. They are given by McGlannan [15] as follows: (1) toxæmia, (2) gangrene, (3) peritonitis, (4) renal disturbances. To this list must be added a fifth complication, namely, dehydration, the importance and probable cause of which have already been suggested, as has also that of toxæmia. Renal disturbances are probably due to the above two factors. Gangrene, as the result of vascular disturbance, and peritonitis, developing through the escape of bacteria from intestines, the seat of injury from vascular disturbances, need but to be mentioned to be appreciated.

One of the common symptoms of ileus is paroxysmal, cramp-like pain which is commonly attributed to tension on mesenteric attachments. Might not this pain be produced in part by local tissue asphyxia, the result of vascular disturbances produced by the prolonged and violent contraction of the intestinal musculature, in other words, by increased intra-intestinal pressure?

The evidence serves to emphasize anew the necessity of early operative interference in intestinal obstruction, of operation before extensive vascular changes have been induced. It suggests a reason why relief of the obstruction and drainage of the bowel even in the absence of infection fail to save a considerable proportion of patients—those in whom thrombosis in the capillaries of the bowel wall and in the mesenteric veins prevents the efficient re-establishment of the circulation upon the removal of the intra-intestinal pressure. It also suggests caution against the too sudden relief of this pressure because of the danger, first, of embolism; second, of acute explosive hemorrhagic infarction

of portions of bowel in which the vascular apparatus might be able to accommodate a gradual return of the blood but would be overwhelmed by its sudden influx; and third, of serious hemorrhage into the intestinal lumen from rupture of the mucosa over areas of explosive infarction.

I wish to acknowledge the courtesy of Dr. E. Wyllys Andrews in giving me opportunity to utilize the clinical observations reported.

## REFERENCES

[1] Meyer: Inaugural Dissertation, Zurich, 1902.
[2] Kaufmann: "Spezielle Pathologische Anatomie," 1909, p. 389.
[3] Finzi: Virchow's Archive, 1913, ccxiv, 413.
[4] Busse: Archiv f. klin. Chir., 1905, lxxvi, 122.
[5] Payr: Münchener med. Wchns., 1905, lii, 793; see also Archiv f. klin. Chir., 1908, lxxxiv, 799.
[6] Friedmann and Hamburger: Journ. A. M. A., 1914, lxiii, 380.
[7] Rosenow: Journ. A. M. A., 1913, lxi, 1947.
[8] Schultz: Proc. N. Y. Path. Soc., 1906, vi, 150.
[9] Burton-Opitz: Pflüger's Arch. f. d. ges. Physiol., 1908, cxxi, 150; see also 1910, cxxxv, 205.
[10] Richards and Ruggles: See Cannon, Trans. Am. Gastro-Enterological Assn., 1912, p. 1.
[11] Wilms: "Der Ileus," Stuttgart, 1906, p. 56.
[12] Stone, Bernheim, and Whipple: ANNALS OF SURGERY, 1914, lix, 714.
[13] Hartwell and Hoguet: Jour. A. M. A., 1912, lix, 82; see also Hartwell, Jour. Exp. Med., 1913, xviii, 139.
[14] Gurd: Jour. Infect. Dis., 1914, xv, 124.
[15] McGlannan: Jour. A. M. A., 1913, lx, 733.

# THE SURGICAL ANATOMY OF THE UPPER AND LOWER POLES OF THE THYROID GLAND WITH REFERENCE TO THYROIDECTOMY*

By Nathaniel Ginsburg, M.D.
of Philadelphia

Operative procedures upon the thyroid gland are rendered difficult or simple in execution largely by the anatomical factors determining the disposition of the blood-vessels related to the upper and lower poles of this body. Accessibility of these vessels is not always easy, owing to the distortion of the gland mass by overgrowth, with consequent upward and downward extension, and displacement of the usual landmarks commonly noted to definitely localize the vessels entering the gland substance.

Severe hemorrhage not infrequently attends partial removal of the thyroid gland owing to retraction of the vessels (usually veins) after incision, or as the result of failure of a ligature to include all the vessels. The troublesome bleeding during the course of this operation is usually ascribable to the veins whose number and size are far greater than the standard text-book descriptions lead one to believe.

Close studies in the anatomical laboratory of the University of Pennsylvania over a number of years, with careful inspections of many hundreds of thyroid glands, dissected in normal position, has impressed the writer with the frequency of the anomalous distribution of the thyroid vessels, particularly the veins (Fig. 1). Clinical evidence to corroborate these views has also been found by the writer in operations upon the thyroid body in the living.

Isolation of the superior thyroid artery is always a simple matter because this vessel is invariably directly related to the upper apex of the lateral lobe, dividing, however, before it penetrates the substance of the gland. The distribution of the blood stream is over the ventral gland surface, a dorsal branch of some size, however, continuing down the dorsomesial surface of the lobe to form an anastomotic channel completed by an ascending branch of the inferior thyroid artery. It is from this anastomotic channel that the parathyroid glands hang and therefore derive their blood supply. Since the division of the superior

* Read before the Philadelphia Academy of Surgery, November 2, 1914.

thyroid into the two main stems often takes place at a distance of from two to three centimetres from the gland, the importance of grasping both vessels in a circumscribing ligature having for its purpose complete pole ligation is significant. It is not by any means difficult to miss the dorsal stem of this artery in passing the ligature, and hence the explanation of a failure to realize an expected improvement in a patient with a toxic goitre after complete single or bilateral ligation of the superior thyroids was thought to have been accomplished.

The superior thyroid vein is usually a single vessel, but, as shown in the illustration, possesses an anatomical relationship to the internal jugular vein, which may give rise to severe hemorrhage after apparent ligation of the superior thyroid vessels has been practised. This short, thick venous trunk, passing transversely into the wall of the internal jugular vein, demands careful ligation, and this is safer than the application of a forceps. The writer was compelled during the past year to ligate the internal jugular vein in two patients, following the retraction of this vein which simulated a punctured wound of the vessel wall. This unusual procedure did not, however, in either instance, complicate the injury or offer any untoward cerebral effects.

The middle thyroid vein is fairly constant, short in length, and likely to be overlooked in lobectomy; especially since traction of the gland mass toward the median line often reduces this vessel to a collapsed thin cord which bleeds freely, if incised, when release of traction takes place.

Occasionally the inferior thyroid artery is wanting on one side, and a huge superior thyroid artery compensates for its absence. Obviously, this anatomical state would be ideal for polar ligation as a surgical procedure, and would rob the whole lobe of a large part of its blood supply. No example of an absent superior thyroid artery has been noted, although this vessel has been seen to arise from the common carotid artery. (This observation was made in the Anatomical Laboratory.)

The inferior thyroid artery is considerably larger than the superior thyroid, and has a more direct origin from the parent vessel (subclavian). Owing to its greater size and glandular distribution, it delivers a greater blood supply to the thyroid gland than its fellow of the same side. It passes vertically upward and thence medianward behind the carotid sheath, and always divides into a number of large glandular branches before entering the gland tissue. The division is opposite the centre of the gland lobe, and this vessel is mistakenly thought by some to have a relationship to the lower pole of the lobe similar to the arrangement which the superior artery bears to the upper

pole. The inferior laryngeal nerve (motor to the larynx) is intimately related to the main glandular branches as they pass across the lateral tracheo-œsophageal sulcus, passing between two or more branches or lying dorsal to all of them.

Ligation of the inferior thyroid artery before division requires retraction of the carotid sheath either lateralward (Halsted), or medianward (Rogers), extending the dissection beyond the confines of the gland capsule, and cannot be easily accomplished through a small incision. Ligation of the main branches before they enter the gland is attended with danger, since the motor laryngeal nerve may be included in the ligature. The peripheral ligation of the vessels in the gland substance, with retraction of the lobe toward the median line, spares both the nerve and the parathyroids and has been the procedure adopted since advised by Kocher, Halsted and Mayo. This method does not ligate the inferior thyroid *en masse*, but makes possible the plastic resection of the lower pole, and is the theory upon which Mikulicz based his suggestion of plastic gland resection, which has been recently mentioned in an excellent paper by Balfour of Rochester, Minnesota.

Rogers of New York advocates quadruple ligation of the thyroid vessels, with nerves included in the ligatures, and reports thirty-six cases of typical exophthalmic goitre operated upon prior to January 1, 1913, by this method. He approaches the lower arteries through a vertical incision over the lower end of the posterior border of the sternomastoid muscle. " The approach exposes and passes in front of the phrenic nerve on the scalenus anticus muscle. The inferior thyroid can then be felt and reached behind the internal jugular vein and common carotid artery."

The conception of this procedure is fundamentally based upon a certainty of accomplishing a reduction of the glandular arterial burden, and no other operation upon the thyroid save total excision will equal it in this respect. The results reported by Rogers upon the thirty-seven cases offers incontestable proof of the value of his procedure. This writer also attempts to explain failure in two of his earlier cases, following quadruple ligation of the thyroid vessels and nerves, in which improvement became stationary, upon the operative findings at the second operation. He states, " exploration revealed a reformation of one or more collateral branches at the primary operation. It is technically difficult to be sure of securing all the twigs given off from the superior thyroid, especially in a nervous subject under local anæsthesia."

It is evident from these latter statements, that at the primary opera-

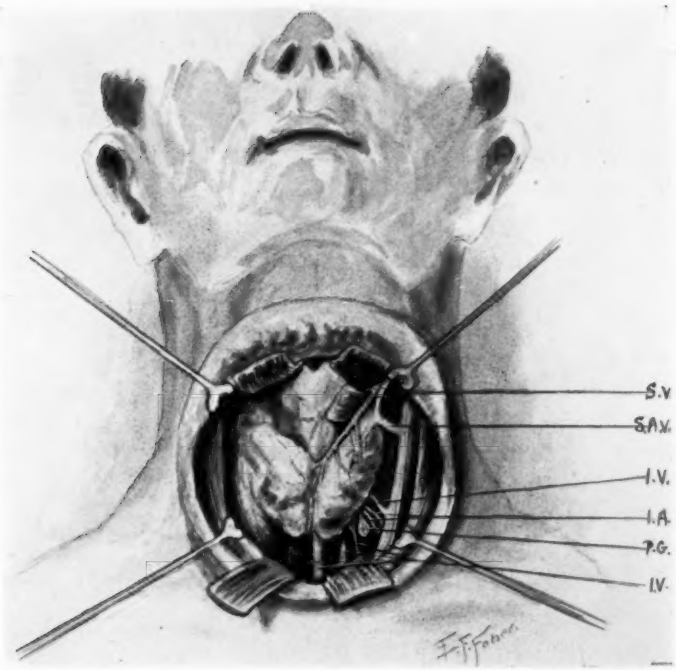



FIG. 1.—*S. V.*, superior vessels; *S. A. V.*, superior accessory vein; *I. V.*, inferior thyroid veins; *I. A.*, inferior thyroid arteries; *P. G.*, parathyroid gland. Note the venous arrangement at the superior pole of the gland, the short vein passing outward at right angles to the gland to enter the internal jugular vein. The inferior vessels are numerous and the veins are very large. Note the large inferior median vein descending along the trachea. Ligation of the inferior thyroid artery before it breaks up into its branches does not affect the venous return from the gland.

FIG. 2.—L. K., aged fifty years. Toxic exophthalmus. Duration of goitre eight years. Weight at operation eighty pounds. Emaciation marked. Bilateral ligation of superior poles of thyroid. Recovery so marked that further operative treatment was unnecessary.

FIG. 3.—L. K., aged fifty years. Same as Fig. 2. Note large left lobe and isthmus.

FIG. 4.—E. M., single, aged twenty-seven years. Intensely toxic goitre. Bed-ridden for three months. Bilateral superior pole ligation had no effect. Secondary right lobectomy with marked improvement.

FIG. 5.—E. M. Note small size of goitre and moderate exophthalmus. Duration of symptoms sixteen months.

tions upon these two patients, Rogers may have missed in the superior pole ligatures the dorsal branches to the gland to which attention has been previously directed. It must not be forgotten that in toxic goitres, of the exophthalmic or non-exophthalmic type, either single or multiple ligation at best only affects the conduction to and from the gland of both blood and gland elements, leaving the increased secretory surfaces still intact, since Wilson and Plummer have proven beyond all doubt that hyperplasia of the thyroid is complementary to hyperthyroidism.

The very free anastomoses of the arterial system, and the great numerical constancy of the veins leaving the thyroid gland, should make one pause and wonder that a single or double polar ligature can very materially reduce the blood supply to this organ. The clinical evidence is incontrovertible in a large percentage of cases (Kocher, Mayo and others), but there are patients in whom no evidence of improvement is noted, following this attempt to diminish the thyrotoxicosis, by reducing the blood supply to the gland and the coincidental delivery of the secretion into the blood system. It is likely that failure in these cases is dependent upon the anatomical factor involving the vessels entering and leaving the gland. Dr. Halsted resorts to ligation of the inferior thyroid in preference to the superior vessels. His technic undoubtedly makes possible successful occlusion of the inferior thyroid artery, since the vessel is secured behind the carotid sheath before division into terminal branches takes place. His ligature, however, does not circumscribe the veins related to the lower pole of the lobe and in this respect the operation only accomplishes one-half of the same procedure applied to the superior vessels. The value of ligation attaches as much to venous occlusion as to arterial interruption, and an examination of the large veins, related to the lobes and isthmus below, will at once prove the truth of this observation. Halsted states that in his clinic preliminary ligation is always practised as the first stage of surgical treatment in cases of toxic goitre to improve the patient's condition and to test the resistance to operation. He further states, " that in no instance have we found that the preliminary ligation of two, three, or even of the four arteries, sufficed to cure the patient seriously ill with Graves' disease, although we have observed that considerable improvement, for a short time at least, may follow the ligation of even a single artery."

The writer performed a double superior pole ligation upon a patient *in extremis* (Figs. 2 and 3), and following a stormy post-operative period, improvement was so marked that further surgical interference was refused and finally became unnecessary. In another case (Figs.

4 and 5), in which long continued medical treatment reduced the patient to almost complete disruption, double ligation of the superior vessels utterly failed to change the clinical picture. Seven weeks after this operation unilateral lobectomy was performed, and the reason for the failure of the first operation became clear. The blood supply, interrupted by closure of the superior vessels, was more than offset by the abundance of blood entering and leaving the gland by numerous and large inferior thyroid vessels. Examination revealed a completely ligated superior pole on both sides, since the linen ligature was examined, and had circumscribed all the vessels entering this portion of the gland.

In spite of the fact that enucleation should be subcapsular and all manipulations carried on close to the gland, troublesome hemorrhage will often arise, and the purpose of this communication is to direct attention to some anatomical factors the knowledge of which will render excision of a part of this organ easy or difficult. Operations upon the thyroid now constitute one of the safest of all surgical procedures, and if toxic cases are treated early surgically, before prolonged medical treatment exhausts the patient, this operation will be placed in the category of results of operations for acute appendicitis when done within the first twenty-four hours.

# URETERO-ENTERIC ANASTOMOSIS

## A NEW ENTERO-URETERAL OPERATION

## AN INDUCTIVE STUDY BASED ON SURGICAL PHYSIOLOGY

By W. Howard Barber, M.D.

of New York

(From the Laboratory of Experimental Surgical Physiology, N. Y. University)

The ureterovesical valves may be destroyed without resultant injury to the kidney tissue. This was amply shown by Draper and Braasch [1] at the Mayo Clinic in 1911.

The causative factors of ascending infection were further studied by Barber and Draper [2] and Stewart and Barber [3] in 1913–1914. From a study of 42 dogs it was determined that:

(1) When the ureters were "stripped" hydronephrosis followed in 75 per cent. of the cases.

(2) When the ureters were "stripped" and the valves were cut, renal infection ascending through the wall or the lumen of the ureter or both followed in 50 per cent. of cases.

(3) When the ureteral vesical implantations were circumcised no kidney changes were observed.

From a review of these conclusions it appeared that:

(1) If the ureters were transplanted without traumatization, preserving the ureterovesical valve or its equivalent was desirable.

(2) If the ureters were traumatized in attempting transplantation, the absence of a ureterovesical valve or its equivalent was desirable.

(3) And in either case transplantation of the ureter was in itself no causative factor, but a protective factor against ascending lymphatic infection.

The problems of the anastomosis of the ureters and the intestine have been shock, peritonitis, cumbersome technic, difficult control of urination, colitis, leakage, hydronephrosis, and primary infective kidney. To these should be added and emphasized, the inevitable dis-

[1] Draper and Braasch: The Function of the Ureterovesical Valve. Journal A. M. A., 1913.

[2] Barber and Draper: Renal Infection; A Further Experimental Study of its Relations to Impaired Ureteric Function. Journal A. M. A., 1914.

[3] Stewart and Barber: Hydronephrosis; an Experimental Study. Ann. Surg., December, 1914.

quietude of the surgeon arising from his ignorance of the intra-ureteral pressure.

From a review of these conclusions it appeared that:

(1) An operation removing the elements of shock, peritonitis and cumbersome technic must be brief, clean, and simple.

(2) An operation removing the objectionable factor of difficult control of urination must result in normal sphincteric control.

(3) An operation removing the occurrence of colitis must involve a mucous surface accustomed to or adaptable to contact with urine.

(4) An operation to prevent leakage and allow cognizance of either the patency or stenosis of the ureter must have an effectual anastomosis and one open to investigation at any time.

(5) Finally, a technic preventing post-operative hydronephrosis and primary infective kidney, if available, is to be found not by hit or miss methods based on anatomical findings, but only through the application of the recently acquired physiological knowledge of the ureter and kidney.

The following operation is not recommended to clinicians for trial at the present writing. Its interest primarily lies in its being the logical sequence of physiological laboratory facts, applied to the recognized problems, incident to the uretero-enteric anastomosis. Of eight dogs so operated upon all survived operation, one alone died within the first week, following sloughing of the ureter from overtension. The others to all appearances resemble normal dogs. It is expected that the following technic shall remove the objections common to other operations and leave but one serious problem for consideration; namely, that of the balance of power and load pertainable to every transposed ureter. For the ureter is necessarily traumatized and reduced in its motor efficiency and resistance is unavoidably piled up at its extreme caudad end. The problem, then, is simply so to reduce this terminal work that the already impaired ureter may physiologically meet it. The following technic is therefore proposed: A mesoventrad incision 5 cm. long is made in lower abdomen. Identify the ureter and free it from its bed. Divide the ureter between two ligatures just cephalad to the bladder. Attach a straight cutting needle to the cephalad ligature and penetrate the sigmoid colon in a line perpendicular to its long axis. Drive the needle through at a point 90 degrees distant on intestinal wall, thus drawing ureter through each wall. The sigmoid is then suspended within the wound by the usual glass rod method. The ligated cephalad end of the ureter is allowed to protrude on to the skin where its liga-

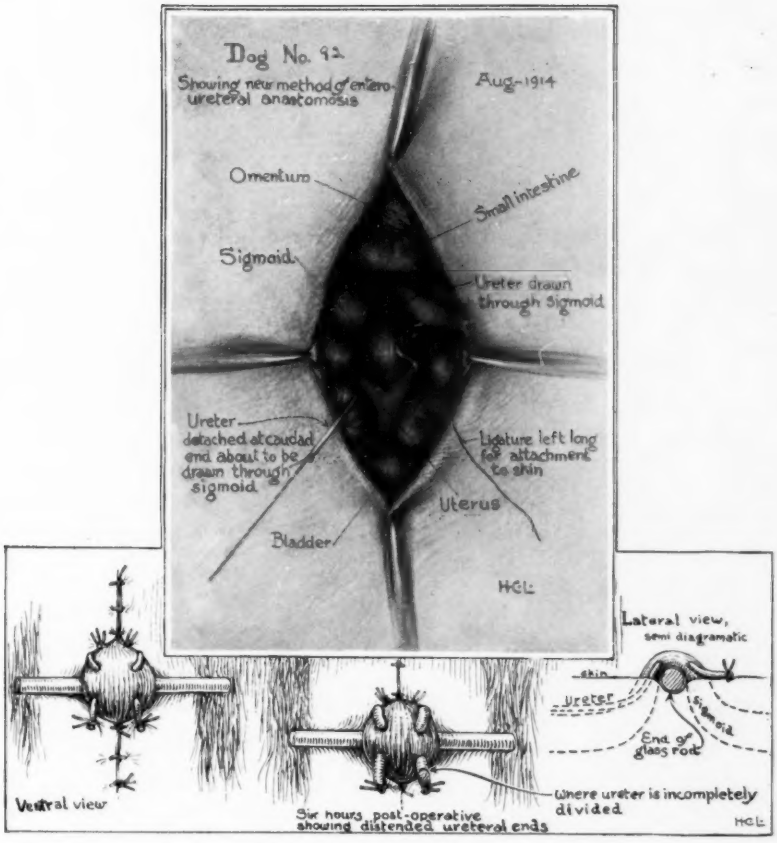



FIG. 1.—Technic of ureterosigmoid transplantation.

ture is fixed by a single suture. The wound is then closed about the sigmoid and the ureter. Six hours later the exposed ureter is incompletely cut and allowed to empty. It may be returned to the lumen of the intestine at any time thereafter, but it is well to retain it under control until its continued patency is assured. One or both ureters may be transplanted in this way within twenty minutes. An exposition of the rationale and an interpretation of the results of the operation is forthcoming.

# STUDIES IN OBSCURE FORMS OF PROSTATIC OBSTRUCTION AND VESICAL ATONY*

By Bransford Lewis, M.D.
of St. Louis, Mo.
PROFESSOR OF GENITO-URINARY SURGERY IN THE MEDICAL DEPARTMENT OF ST. LOUIS UNIVERSITY

*Importance of Etiology.*—A correct understanding of the exact causation of urinary obstruction and its congener, vesical atony, and the rationale of their interrelationship should have a most important bearing on the practical questions involved in such conditions, such as the determination of appropriate treatment, the success or failure prospective, in fact, the whole prognosis of the case.

*Curability.*—For instance, dependent on the question as to whether there is or is not such a condition as permanent vesical atony, may hinge the determination as to whether it is worth while or justifiable to operate for relief of an existing obstruction causing the atony. It is claimed by some that no matter how long a bladder has stood widely dilated from chronic obstruction, it still has enough recuperative power to "come back," as pugilists say, and re-engage in the duty of expelling the vesical contents, provided the obstruction be effectually removed.

Albarran, Young, Chetwood, Freyer and others seem in accord in this belief; and assert that incurable atony is practically never encountered.

But there are others who hold there is such a condition as *essential atony,* irretrievably lost to all hope of recuperation, even though a recognized obstruction should be completely removed. If this be true, the argument that it is useless in such cases to subject the patient to a radical operation for removal of obstruction is well founded; and operative endeavor is, under such circumstances, predestined to failure and should not be undertaken. They further argue (Binney) that the hopelessness of such cases should be recognized in advance and included in the diagnosis and that measures should be based on such recognition.

Certain authors believe that hopeless atony exists not only in consequence of obstruction or nerve degeneration but also in the absence of any obstructive factors; in other words, that permanent and irremediable atony may exist even where no cause for it, in the shape of an obstruction, can be found.

---

* Read before American Urological Association, June 18, 1914.

*Unaccountable Cases.*—Byron Robinson (*Int. Jour. Surg.*, December, 1909) remarked on the surprising frequency with which, in doing a thousand autopsies, one would run across dilated ureters and other physical evidences of damaging obstruction to the upper urinary tract and yet fail utterly to discover a cause for it. While no cause could be discovered, it was evident, he declared, that a potential factor must have existed.

Albarran and Nogués (*International Congr. of Urology*, Paris, 1908) reported two cases of atony of the bladder without known cause, in young men. These authors believed that the atony, when permanent, was due to senile degeneration of the bladder muscle from arteriosclerosis.[1] Asch (*Deutsch Med. Woch.*, 1909, p. 1293) reported the cases of four men and seven women, in whom he found atony with trabeculation, all obstructive and nervous causes being absent. This author attributed the condition to primary degeneration of the vesical muscles dependent on disease of the vesical nerves or of the ganglia of the vesical centres.

Under the title, "Atony of the Bladder without Obstruction or Signs of Organic Nervous Disease" (ANNALS OF SURGERY, November, 1910), Thomson Walker presented a striking report of twelve cases which formed for him an unsolved problem.

While this author realized that these cases deviated from the typical and traditional forms of prostatic obstruction and retention, he was not clear as to their etiology or nature. He excluded disease of the cord or nervous system by reason of the absence, for a sufficient length of time, of general symptoms of such; but was inclined to believe that they were explained by the existence of *some lesion of the sympathetic reflex centre*, which controls the functions of bladder and rectum, according to the theories of Goltz, Freusberg and Ewald (*Pflüger's Archiv.*, Band 8, 9 and 63).

*Various Theories of Causation.*—The French school, with some exceptions, has been inclined to the pessimistic belief, founded by Guyon, that urinary retention of the aged is due to degenerative processes (arteriosclerotic) involving not only the prostate but also the bladder wall and the kidneys. It stood as their most logical explanation of "prostatism sans prostate" (prostatism without hypertrophy). Though often denied, this claim seems still to have some advocates. Ware invokes it in discussing "Non-prostatic Urinary Retention

[1] Quoted from Binney, Transactions American Association Genito-Urinary Surgeons, 1911.

of the Senile Bladder" (ANNALS OF SURGERY, January, 1911); but also utilizes the vesical degeneracy theories of Halle and Motz, of Ciechanowsky, and of Zuckerkandl, the latter of whom said:[2] "Senile changes or chronic destruction are capable of seriously damaging the bladder muscle in its function. There are incurable forms of retention amongst the senile in whom no mechanical or nervous cause can be determined. Whether an atrophy or degenerative muscle is out of fix is not known."

Arguing that not obstruction at the neck but *incompetence of the vesical walls* is the explanation of such cases of retention, Ware applies the shotgun method and invokes all of the factors and influences available, ascribing the atony to "vascular, myogenic, neurogenic or infectious origin: and that in some cases all of these factors operate towards the same end."

Binney (*ibid.*) supports the contention for essential incurable atony by reporting two cases of complete vesical retention that were unrelieved by prostatectomy.

He terms Ware's explanation, above quoted, vague and unsatisfactory; and attributes the detrusor weakness of such cases to diminished blood supply, promoted by arterosclerosis, on the one hand, and by atrophy from over-stretching of a poorly nourished musculature, on the other.

Lately comes Carraro, of Milan, Italy (*Revue Clinique d'Urologie*, March, 1914), who, supporting a suggestion of Motz and Arrese, declares his belief that the source of obstruction in these unaccountable obstruction cases lies in the presence of *prostatic adenomata*, which, though small in size, are effectively placed and lead to obstruction by impinging, in a manner scarcely perceptible, on the internal sphincter. This harmonizes with the views of Marion, who, reporting a number of cases of prostatism without hypertrophy, had been able to establish very small perivesical adenomata as the cause of the retention. Only the finger of the surgeon is capable of appreciating such minute adenomata, which escape detection by the cystoscope.

*Divergence of Theories.*—The most striking impression one gets from reviewing the doctrines above quoted is of their wide divergence and lack of harmony. Certain of them place the blame on the detrusor system, which is deemed too weak to expel the vesical contents, while others ascribe the fault to the neck or sphincters, which are too strong, and in some mysterious or unrecognized way offer undue resistance,

[2] Handbuch der Urologie, 1904, vol. i, p. 720.

giving retention. Whether from the one cause or the other, it is apparent that the happy "balance of power" that normally exists between the two systems, detrusor and sphincter, is upset, leaving urinary retention and, often, vesical atony in its wake. That is the condition. The question is, What is the causation?

Study of a number of cases of urinary retention of obscure origin impels the writer to register his dissatisfaction with the theories propounded and previously quoted as explaining these conditions and to call attention to some features of causation possibly overlooked.

*Author's Views.*—The writer is a partisan of the belief that urinary retention is occasioned by two causes only, namely, mechanical obstruction or nervous influence (interference with the nervous mechanism controlling urination). If we do not perceive which of the two is in play it is but an evidence of our human frailty in diagnosis. Such cases must be studied in detail and analyzed critically.

In the first place, there are many such cases in whom senility or arteriosclerosis can have no place whatever. The writer has observed a number who have experienced difficulty in urination from their earliest infancy. Their recollections have been connected with prolonged and troubled efforts at urination, impeded stream, straining, accompanied by the scoffing of boy companions who were more expeditious in their accomplishment of the act.

CASE I.—One such patient, E. A. H., who came in 1904, when twenty-nine years of age, was then found to have a widely dilated, atonic bladder, dilated ureters and kidneys, one of the latter a mere sack (hydronephrosis) that had to be opened up and drained to be restored to functional activity. By perineal urethrotomy the life-long retention was demonstrated to be due to non-hypertrophic obstruction located at the vesical neck (contracture); and was only relieved after incisions had been made through a perineal opening, including electric incisions, opening up this offending region for the free escape of the urine. The young man then made an excellent recovery, his vesical contractility and ability for free and easy urination were restored or, rather, established *for the first time,* so far as he could remember; after years of chronic retention and invalidism he became able to go back to active duties on his farm, which satisfactory condition has continued now for about nine and one-half years. A letter recently received from the patient declared that his health was excellent and he was able to do hard work on the farm. Wassermann test of his blood recently made was negative.

*Criticism of Theories Quoted.*—The claim (Asch and others) that the defect lies always in degeneration or incompetence of the *vesical walls* cannot be true, because in many instances evacuation of the bladder is prompt and complete on the introduction of a catheter; and this, too, in the presence of the so-called "atony without obstruction." The writer believes that, in the absence of the nervous factor, the form or nature of the obstructing factor is simply not recognized in such cases.

The measures and means described as justifying the exclusion of physical obstruction do not seem beyond criticism or capable of justifying such conclusions. Thus, Thomson Walker bases his exclusion of physical obstruction in his twelve cases on the following: "First, no evidence of obstruction could be obtained. The anterior urethra was examined in most of the cases with the urethroscope under air distention. In all of them large metal sounds were passed (13–15–17) and the vesical orifice of the urethra was examined with the cystoscope. The rectal surface of the prostate was examined with the finger and the vesical surface with the cystoscope. No abnormality was detected by these methods."

The writer would say that personal experience would class these measures as insufficient to permit of the exclusion of certain forms of obstruction, particularly contracture of the neck. This condition is not subject to detection or exclusion by palpation through the rectum nor cystoscopic view within the bladder; and, moreover, sounds of full size or even soft rubber catheters may pass without giving the slightest indication of such an obstruction, although it is really present and causing retention. These facts were forcibly drawn to the writer's attention in a patient under his care during the past year:

> CASE II.—B. L., age thirty-nine. This patient, also, had had slow and difficult urination from boyhood. His earliest memories were connected with difficult urination. Slow starting, slow running, if deferred for any time it would come only in drops. The condition became so bad that the patient had resorted to the regular use of a catheter for the month or two previous to his coming.
>
> There were about twenty-four ounces of residual urine, marked atony, trabeculation, and one large diverticulum evidenced by cystoscopy. It was readily determined that his obstruction was located at the vesical neck, probably due to prostatic contracture, notwithstanding the fact that none could be seen by cystoscope or felt by instruments. He was tested out along these

lines, however, by the regular use of the Kollman dilator, reducing the residuum from twenty-four ounces to three ounces, where it was maintained only with difficulty and repeated stretching, up to 37 or 39 (French). Because these very considerable dilatings did not secure lasting beneficial effects, it was thought by some who were interested in the case that the diagnosis must be erroneous, and that a prostatectomy was indicated. Convinced that a more radical procedure than dilating was justified by the partial failure of the latter, the writer made a perineal incision and introduced his finger into the vesical neck. He found a distinct ring of fibrous tissue whose obstructive influence could not further be denied. It was attested by others present. There was no enlargement and no indication for prostatectomy. Incisions were carefully made through the ring by probe-pointed bistoury, and a drain tube was left in. Even this was not sufficient to secure lasting relief from the obstruction and the procedure had to be repeated a week later, after which there was free natural evacuation.

In this case definite obstruction (contracture) was proved present after it had failed of detection by the several methods and means mentioned as having been relied on by Walker to exclude the existence of obstruction.

CASE III.—*Obscure Contracture at Vesical Neck.* A. F., age forty-five, carpenter, American, married. Referred by Dr. F. A. Renner, Benld, Ill., January 27, 1911.

*Past History.*—One attack of specific urethritis in 1908, lasting two or three months actively, with inflammatory complications in prostate and epididymis. Following this, an abscess of the prostate developed and broke into the urethra, which discharged pus actively for two weeks. No other venereal disease.

*Present History.*—After the discontinuance of discharge from the abscess of the prostate, patient noticed some difficulty in urination. This became more marked and continued until the time of his first consultation.

*Examination.*—Evidences of obstruction were very plain. There were straining, prolongation and marked efforts at evacuation, the incompleteness of which was shown in three or four ounces residual. Neither hypertrophy nor atrophy was observed by rectal palpation or cystoscopy, and no pathological lesion was discovered other than contracture at the vesical neck. This was demonstrated both by exclusion and by the fact that the deep urethral dilator became tight and painful when enlarged to 23 (French) within the prostatic urethra. No evidence of nervous or other organic disease was present and it was concluded that

the obstructive contracture followed the infective inflammation and abscess formation in the prostate.

*Treatment.*—Patient was given regular post-urethral dilatings, gradually increasing from 25 to 40 (French), followed each time by antiseptic irrigations. Under this treatment improvement was prompt, steady and sustained, rendering him capable of completely evacuating his bladder and resuming normal frequency and ability in this line.

CASE IV.—*Congenital Contracture.*—V. S. H., age thirty-two, salesman, December 21, 1909. Since infancy had frequent urination—five to eight times during the day and once at night. Stream was never full or free, but just leaked out and with interruptions. At age of fourteen had complete retention for one night. In infancy (mother's statement) a doctor passed a sound. Condition remained about the same until the age of nineteen, at which time he took some medicine (without an examination). Later, however, an attempt was made to pass sounds. Following this another doctor used sounds and Kollman dilator, which aided him in passing a stream for the first time. Was better until age of twenty-one when he acquired gonorrhœa and syphilis. Was treated three years for lues. Incidental effects of the gonorrhœa lasted until the time of his consultation—frequency and burning.

*Examination.*—Cystoscopy revealed a tender and diffusely inflamed bladder. Catheterization of ureters gave normal urine from the left side but that from the right contained many bacteria (colon) and epithelial cells. No pus.

*Treatment.*—Recovery followed deep dilatings and posterior irrigations. Dilatings for six months advised.

It is probable that contracture is the " potential factor " that is either overlooked in some cases or is so elusive that it is difficult of detection save by direct palpation through the opened bladder or urethra. In default of such open palpation, in doubtful cases, the therapeutic test should be applied, namely, Kollman deep urethral dilatings regularly and progressively administered while the effect on the residual urine and ease of urination are being watched and compared. Some of the most modern posterior urethroscopes (McCarthy's and Buerger's), as well as the retrospective cystoscope, give an excellent view of the vesical neck and internal sphincter and render material assistance in solving the local diagnosis of such conditions.

*Minute Adenomata.*—The bearing of minute adenomata on such obscure obstructions, as suggested by Carraro, will have to be further studied before the claims of its author can be conceded. The fact that

many such cases are relieved either by dilating or electro-incisions, without the removal of tissue, would seem to militate against the frequency or importance of this as a causative factor.

It seems likewise improper to admit the claim that the failure of a prostatectomy to relieve retention is evidence of unreliable atony. Not infrequently after prostatectomy (particularly the perineal) conditions are not altogether satisfactory for a time. The irregular conditions left after the enucleation have to be smoothed out, and the patient often has to learn over again the act of urinating—which may have been so long in abeyance that he has forgotten it. Surely, the "class in urination" of the late Dr. Sam Alexander is not already forgotten; in which a number of his prostatectomy cases were daily lined up for instruction and rehearsal in starting and stopping the urinary stream.

It has been the habit of the writer not only to utilize instruction of this sort in certain hesitating convalescent prostatics, but also to make use, where demanded, of a sound or Kollman dilator for favoring control and recovery.

*Bearing on Spinal Syphilis.*—Even where there is no physical obstruction at the neck there may be a potential one—as that occurring in connection with tabes or other form of spinal lesion. The retention and extreme atony in these cases are due to the relative obstruction offered by the vesical sphincters, which are simply incapable of being opened up before the crowding urine, impelled by the normal amount of detrusor pressure. The detrusors may be as strong as ever, but they have a *relative* obstruction to deal with now in the inert and therefore *resisting sphincters.*

*Impending Change of Views.*—In view of the flood of light being shed on this subject by the far-reaching Wassermann tests, it is probable that current views are destined to undergo much change in the near future, if they have not changed already.

Formerly, until the grosser evidences of tabes or spinal syphilis appeared, in the shape of impeded gait, or vision, ataxic pains, etc., it was difficult to detect such a cause as tabes behind a crippled bladder, the subject of chronic retention and atony. Now we have the Wassermann tests, both blood and spinal fluid; and the harvest is something surprising; the veil is being drawn from many cases that have proved most puzzling. Within the past two years we have had a number of cases in which men of middle or advanced life, sedate and settled, with grown children, so far past the period of youthful indiscretions that they have almost forgotten them, have developed urinary obstruction and its sequelæ of urinary frequency, retention, vesical dilatation, and

atony. Some have become the objects of various kinds of surgical treatments or assaults, including, perhaps, removal of the prostate, all without benefit to the retention; and finally, on examining and analyzing the cases closely, we have found them to be simply presenting the earliest evidences of spinal syphilis hitherto unrecognized by the patient or his physicians, which diagnosis has been confirmed by Wassermann blood or spinal serum tests. Such a revelation has proved not only astonishing to the patients, as an immediate result, but far reaching and vastly important from the therapeutic stand-point.

Adopting the valued experiences and teachings of Swift and Ellis, we have followed up this diagnosis with intraspinous injections of salvarsanized serum, and in certain cases with equally as striking and gratifying results.

Illustrating the insidiousness and obscurity of such causation, the following cases are briefly mentioned:

CASE V.—C. E. C., age fifty-one, American, married. Referred by Dr. W. B. Yost, March 11, 1911.

*Family History.*—No family history indicative of lues or other affections that would have a bearing on the case.

*Past History.*—No history of gonorrhœa, lues, sore or other condition pointing toward a specific infection.

*Present History.*—Had never noticed any disturbance directly connected with genito-urinary tract. Four months previous to his first consultation, he had consulted Dr. Yost on account of slight fulness and distress in abdomen; also indigestion of moderate severity. In the course of his examination the doctor catheterized the patient and to his astonishment drew off 160 ounces of urine. This relieved the feeling of heaviness and fulness in the abdomen immediately. On close questioning it developed that he had some retardation in beginning and completing urination. Following this, patient catheterized himself three times daily for three months without definite improvement, at which time he came to me.

*Examination.*—Testing out the findings of the condition reported, we had the patient urinate all he could voluntarily, amounting to 14½ ounces, after which a soft rubber catheter was easily passed, drawing off 60 ounces of clear, uninfected urine. Examination by all methods, including cystoscopy, failed to disclose any prostatic hypertrophy or contracture. Neither were there any evidences of a spinal lesion.

*Treatment.*—Patient was placed on regular deep urethral dilatings, going rapidly to 40 and 45 (French). His ability to urinate improved very considerably and then he stopped treat-

ment. Recently, at my personal request, he submitted to the taking of blood for a Wassermann. This proved suspiciously positive; another specimen a week or two later showed plainly two plus positive. Patient would not submit to a neurological examination, but, during the time he was under our care, no indication of ataxia or other spinal lesion was noticed.

CASE VI.—L. J. A., age forty-six, American, married.

*Family History.*—No family history indicative of lues, paralysis or nervous disease.

*Past History.*—When about eighteen years of age patient had gonorrhœa lasting about two years; recovery. No other venereal disease. No history of sore, headaches, general eruption or local lesions. Attack of "mountain fever" twenty-five years ago.

*Present History.*—Two years ago began noticing difficulty in urination, requiring longer time and straining to evacuate. February, 1913, became unable to control it, coming involuntarily, occasionally. Some difficulty in walking was observed at the same time and sexual ability and desire became lost. Consulted several physicians, who gave various diagnoses and treatments.

*Examination.*—Examination showed no enlargement of the prostate, stricture or other obstruction at the neck of the bladder, in spite of twenty-three ounces of residual. Neurological examination disclosed complete absence of knee jerks; hesitancy in speech, marked tremors of facial muscles, sensation of pain greatly diminished in lower limbs and a very unstable station. Argyll-Robertson pupils.

*Treatment.*—Patient was placed on deep urethral dilatings and irrigations and residual was reduced to one-half ounce (February 11). Wassermann of blood was four plus positive. Was given intraspinous injection of neosalvarsan (per Swift-Ellis method). Following this there was improvement in eyesight, limbs felt stronger, and station was more stable. Two weeks later a second intraspinous injection was given. Spinal fluid gave a four plus Wassermann.

One month later examination of patient was made with following results: Condition of pupils unchanged. Facial muscles equal; no deviation of tongue. No intrinsic or extrinsic tremors. Abdominal and cremasteric reflexes sluggish. Knee jerks present but sluggish on both sides. Slight Babinski on both sides. Station fair, enunciation improved. Marked improvement in sexual ability and desire. Residual reduced from 23 ounces down to 1 or sometimes 2 ounces. General condition much better.

CASE VII.—A. C. H., age forty-five, American, married, farmer. Referred by Dr. E. J. Burch, January 24, 1911.

*Family History.*—Negative.

*Present History.*—From earliest childhood patient had had trouble in urination; required a long time, stream was slow and difficult, accompanied with much straining. Denied all venereal disease. Following a rupture in 1909 had been catheterized and a pint of residual drawn off. Bladder then became irritated with frequent urination, pain and other evidences of infection. Wore retained catheter for a year and a half with some relief. At the time of consultation had to urinate every two hours both day and night.

*Examination.*—The stream was slow and retarded, dropping indolently downward. Soft rubber catheter was passed easily and 10 ounces of cloudy, infected (colon bacilli) urine drawn off. There was no enlargement of the prostate or contracture at the vesical neck; no organic or spasmodic stricture. Ureteral catheterization gave purulent, infected urine from both kidneys.

*Treatment.*—Dilatings and tonic vesical irrigations were given and served well to restore to a striking degree the ability of the patient to empty the bladder and return to work.

Recent Wassermann on this patient gave a feebly plus positive, but we have had no opportunity for a neurological examination. This had been considered as one of the unaccountable cases of retention until the revelation made by the Wassermann blood-test placed it in the category of luetic spinal effects.

CASE VIII.—P. R., age fifty, American, bookkeeper, married. Consultation April 18, 1907.

*Past History.*—Sore on penis 27 years previous. Following this alopecia and sore throat. Five attacks of urethritis during last 30 years.

*Present History.*—Following the gradual development of a contracted stream, his surgeon diagnosed "stricture," and cut internally in 1898. Patient complained of great pressure when the bladder filled and urine escaped involuntarily. No undue frequency of urination. Stated he had occasional severe pains in his legs, almost causing him to fall.

*Examination.*—Large soft rubber catheter was passed easily and seven ounces of cloudy, bad-smelling (acid) urine drawn off. Cystoscopy revealed nothing except a somewhat funnel-shaped internal meatus. Dr. W. W. Graves made a neurological examination of the patient and reported greatly disturbed sensation all over the body; slight inequality of tendon reflexes; unequal pinhead pupils; deficient mentality. He stated that there was little doubt that the patient had had a luetic infection at one time.

CASE IX.—*Mixed etiology.* A case in which both spinal lues and contracture may be factors is the following:

F. C., age forty-six, American, salesman, married, October 26, 1912.

*Past History.*—Gonorrhœa, 1886; 1887, after drinking a great deal of liquor, had retention of urine and had to be catheterized. Following this had sounds passed, which treatment was repeated many times at intervals; once with divulsion and internal urethrotomy.

*Present History.*—Now has great difficulty in urinating. Says he passes catheter easily, but when he attempts to urinate something seems to drop down and obstruct the passageway. Says he has about one pint residual.

*Examination.*—Cystoscopy showed moderate congestion of bladder mucosa but nothing to account for obstruction. Soft catheter (18 French) introduced easily. Buerger endoscope showed marked ring of mucosa located at prostatic apex. Behind this was a deep pocket holding approximately two to three drachms with the verumontanum appearing anteriorly on the inferior wall. Posterior to this was the internal orifice with internal sphincter.

*Treatment.*—Perineal urethrotomy confirmed the ring of contracture and cavity. Incision through obstruction until good entrance was obtained. This was followed by deep urethral dilatings. Result: Complete emptying of bladder with exception of ¼ to ½ ounce. Stream good. Wassermann, February 21, 1914, was four plus positive.

CASE X.—*Obstruction Consequent on Hereditary Syphilis.* The influence of hereditary lues is markedly shown in the following case:

Wm. J. H., age nineteen, American, single.

*Family History.*—From patient's statement family history negative. Later developments showed a strong positive Wassermann in father.

*Past History.*—Denied all venereal disease. Beginning about the age of ten patient noticed some difficulty in urinating—took him a long time and required much straining and stream had little force. Flow was irregular. Had some pain in connection with urination. Was not relieved after the act, still had desire. Felt nervous.

*Present History.*—Three years ago, while straining at stool was seized with severe pain in glans penis and scrotum, lasting one-half minute. One month later had a second attack, followed in a week by a third, with pain in bladder, rectum, penis and lack of control of urine. Consulted six or eight different doctors who made various diagnoses, *e.g.*, "irritation of bladder," "ner-

vous lack of control," " acid urine," " strictures," " hypertrophied prostate," etc. Had " suprapubic prostatectomy " and opening has never healed. Had no recurrence of above mentioned pains until two months ago, when sensation of scalding in bladder began. Urination was difficult. Most of urine came through wound.

*Examination.*—General condition bad, run down, nervous. Suprapubic wound leaking. Prostate and vesicles palpable. Three drops mucopus on massage. No enlargement. Cystoscopy showed opening of fistula on superior wall. Small papilloma at side (granulation tissue). Buerger endoscope showed contracture at vesical neck. Five ounces residual.

Neurological examination: Facial expression dull; pupils widely dilated, left larger than right; both irregular; react to light and accommodation. Station fair. Knee jerk absent on left, normal on right. Sensation to pain markedly diminished below knees and on inner surface of thighs. Wassermann four plus positive.

*Treatment.*—Patient was given regular deep urethral dilatings and irrigations. Dilating was carried up to forty (French). Was given two injections of neosalvarsan, followed by intraspinous injection per Swift-Ellis method and four injections of salvarsan by intraspinous method. Spinal fluid four plus until last injection, at which time it was two plus. For last two months patient has had no residual whatever.

Until it was suspected as the underlying cause of the urinary retention, and proved by laboratory tests, confirmed by clinical research, none of these patients or their physicians had the slightest suspicion that syphilis was a factor or had ever been present with them. The father of the boy (Case X) was only suspected because we deemed the syphilis of the son hereditary. He (the father) showed a four plus Wassermann, notwithstanding that he declared he had never had any manifestations of the disease. The son had never had any venereal disease. So the hiatus between syphilis and the mysterious vesical malady of the son, according to ordinary methods of computation, was a long one; so long, indeed, that it might never have been thought of had he not acted as nurse for his little nephew one day when visiting our office, and the child showed evidences of hereditary syphilis in its teeth and nares. This put us on the trail of family investigation and revealed syphilis in the child, its mother, its grandfather and its uncle, the boy who had been the interesting subject of so many medical and surgical vicissitudes, as related.

Such cases of concealed syphilis are usually " treated " for the more

usual forms of prostatic obstruction, and they are indeed fortunate if they escape an attack on their prostates long enough for their real condition to be found out.

*Advantages of Early Recognition.*—Fortunately, too, a correct diagnosis leads not only to the avoidance of measures entirely inappropriate, but impels one to the modern measures that have proven so efficient in the earlier periods of nerve syphilis; namely, the prompt and repeated use of salvarsan or neosalvarsan, both in the veins and the spinal canal, backed up by the iodides and the intramuscular injection of mercury. Locally, also, much can be done for improving the power of the bladder to empty itself. Repeated overstretching of the vesical sphincters, just as with contracture, etc., promotes ease of urination and reduces the residuum. Intravesical irrigations are used in connection with these measures.

*Retention without Obstruction.*—Whether there are cases of chronic retention and atony absolutely free from all kinds of obstruction or nerve lesions, it is hard to say. Before the developments of the Wassermann tests the writer was inclined to believe there were such. Now it seems advisable to again subject such cases to the scrutinizing research of Wassermann tests.[4]

*Incoördinative Retention.*—As mentioned elsewhere[5] the writer believes that the syphilitic spinal degeneration produces an incoördinative retention because of *relative* sphincteric obstruction. A similar relative sphincteric obstruction is produced in the absence of syphilis, through habits of postponement of urination, the tardy relief producing obtunded sensibility of vesical nerves that finally results in dilated and atonic bladder, incomplete evacuation, chronic retention, and possibly the secondary effect of overflow-incontinence. The writer has recorded a case of spina bifida with such sequence. The patient, an adult male, failed to wear a protector over the spinal protrusion, which was thus rendered subject to jolts and contusions in his earlier life that, as explained in consultation by Dr. W. W. Graves, resulted in a subacute neuritis involving the vesicospinal centre and obtunding the nerve filaments at the periphery (the vesical neck). Thereafter desire to urinate was not aroused promptly on the filling of the bladder, so that frequent over-stretching ensued. Following this came atony, further tolerance, and chronic retention, with total inability for voluntary urination. No

[4] In several of our cases of urinary obstruction, formerly held obscure or unaccountable, subsequent investigation has shown the cause to be syphilis unrecognized up to that time.

[5] Keen's Surgery, vol. lv, p. 300. *Ibid.*, p. 301.

other factor for developing the retention could be discovered in this case.

CONCLUSIONS.—1. The exact causation of urinary retention should be sought for in all cases before adopting a plan of treatment.

2. It should always be found in one of two factors, viz., (*a*) physical obstruction of some kind, or (*b*) disturbance of the nervous mechanism controlling urination.

3. There is no such thing as "unaccountable" atony or urinary retention; such a term represents an incomplete diagnosis.

4. There is no such thing as "incurable atony" except when it is caused by some nerve-degenerative process (tabes, etc.) that precludes restoration of the expulsive power; and it is unjustifiable in the most of these cases.

5. Even when the retention and atony are caused by nerve degeneration much can be done in the way of treatment, both locally and internally, to facilitate urination and improve the conditions prevailing.

6. Where the cause is a physical obstruction, its complete removal paves the way to restoration of the expulsive power.

7. The most frequent and important of the obscure, unrecognized causes of obstruction are: (*a*) ill-defined contracture at the vesical neck (demonstrable sometimes only by palpation through the opened bladder or urethra); (*b*) unrecognized syphilis, acquired or hereditary, affecting the spinal centres.

8. Such conditions are by no means confined to adult life, and should be looked for and recognized at any age, from infancy up; diagnosed and treated in accordance with the refined diagnosis always demanded by cases of urinary obstruction.

9. Syphilis is a surprisingly frequent cause of such conditions. Lack of syphilitic history or general nerve symptoms, in obscure cases, should not preclude investigation by means of a Wassermann blood-test; and if this proves doubtful, a Wassermann test of the spinal fluid should be made as well.

10. The supreme value of early recognition and differentiation of such cases appears in the opportunity it offers of affording appropriate treatment before the case has assumed the hopeless phases that preclude reclamation or benefit.

A final, but too late, recognition is but poor solace for a lifetime of suffering due to delinquencies in diagnosis.

# ON THE LYMPHATIC DRAINAGE OF THE PERITONEAL SAC

By William Cavan Woolsey, M.D.
of Brooklyn, N. Y.
(From the Department of Surgical Pathology of the College of Physicians and Surgeons of New York)

The lymphatic drainage lines from the subdiaphragmatic viscera are factors of which we have some definite knowledge. The subperitoneal, submucous and interlobular visceral lymph capillaries drain through collecting radicles into definite groups of neighboring lymph-nodes and from these nodes efferent vessels eventually empty into the lumbar trunks, receptaculum or thoracic duct.

Clinically, the anatomical relation that definite groups of nodes bear to definite organs and areas and to each other enters into the pathological conception of all infections of the abdominal cavity and visceral malignancy. Metastatic deposits in tissue distant from a primary carcinomatous focus are observations too common to arouse comment. Malignant invasion of the liver from the breast by means of a retrograde permeation of the epigastric or costoxiphoid lymphatic channels has long prompted surgeons to adopt the routine removal of these avenues of extension in operations for carcinoma of the breast. Deaver and Pfeiffer (*A. J. M. Science,* 1912) consider clinically the important relation between infections of the gall-bladder and pancreatitis and the lymphatic intercommunication of gall-bladder with duodenum and pancreas. Infections of the appendix may travel far indeed when the spread of its outgoing lymph stream may be known to reach the upper abdomen.

Sweet and Stewart (*Surg., Gynec., and Obst.,* vol. xviii, 4) offer considerable evidence that the ureteral submucous and subperitoneal lymph-channels are the avenues of extension for infectious processes from the bladder to the kidney and not the ureteral lumen.

On the other hand, the peritoneal sac, so far as we know, having but a limited lymphatic function to perform under normal circumstances, seems to possess distinct and extremely active potential lymphatic absorption lines. These appear to be independent of those of the visceral system and not confined to the central tendon of the diaphragm, as Muscatello taught in 1895, but are present over the whole surface of the dome of the diaphragm.

Poirier and Cuneo have described the diaphragmatic lymphatics as forming glandular groups on the convex or pleural surface of the diaphragm, arranged as a few small nodes posteriorly between the crura, two small middle groups placed laterally and several anterior groups including the costoxiphoid glands of Sappey. These latter anterior groups receive afferents from the liver through the falciform ligament and send efferents to the retrosternal chain of lymphoid tissue. The hepatic radicles from the falciform ligament of the liver unite in a short trunk at the ensiform to penetrate the diaphragm and empty into the costoxiphoid nodes.

From the internal mammary chain efferent lymphatics join the thoracic duct at or near the subclavian vein or enter the subclavian independently. Efferent channels from the posterior and lateral diaphragmatic groups are said to drain posteriorly into the juxta-aortic nodes or direct into the duct. Afferent vessels to these diaphragmatic nodes are not mentioned. The problem of investigating lymphatic drainage from the peritoneal sac has been studied by Von Recklinghausen, Poirier and Cuneo, MacCallum, Muscatello and many others and has been carried on by means of the injection of foreign agents into the peritoneum and histologic study of the diaphragm.

Prominent among the questions that arise in a consideration of this subject are:

1. The physical integrity of the mesothelium covering the abdominal aspect of the diaphragm, as to the presence or absence of openings of sufficient size to be called stomata (Von Recklinghausen, 1865).

2. The exact manner and path of absorption from the peritoneal cavity of injected foreign agents.

3. The existence of a direct lymphatic absorption as opposed to or in conjunction with a hæmatogenous absorption.

4. The activity of the diaphragmatic lymphatics in assuming the major rôle in such absorption.

Question 1: No observer since Von Recklinghausen has been able to offer any satisfactory evidence of openings in the diaphragmatic peritoneum, by virtue of which the peritoneal sac becomes a unit with the lymphatic system. MacCallum (*Johns Hopkins B.*, vol. 14, 146) reports a most complete histologic study of the diaphragmatic peritoneum and finds no evidence of such stomata. After repeated and careful study of the flat-celled mosaic which covers the diaphragm the writer wishes to confirm this report. Tangential, protargol impregnated sections (Fig. 1) show no break in the perfect approximation of cell to cell, of sufficient size to be in any sense considered as a mouth or stoma.

Furthermore, it seems to the writer of little pathological consequence whether it is generally believed that such openings do exist or whether, as occurs in the metabolism of the vegetable cell, certain foreign substances are abundantly able to migrate intra- and intercellularly by means of a process of cell inclusion and extrusion described by Pfeiffer (*Physiology of Plants,* vol. i, p. 3) as the translocation of foreign agents by streaming movements of the cell protoplasm.

Question 2: Muscatello (Virchow's *Archives*), 1895, and Buxton and Torrey (*J. Med. Research,* vol. xv, No. 1, July, 1906) made the remarkable observations that finely divided particles of carmine, carbon, chicken blood corpuscles and dead micro-organisms were transported from the peritoneal cavity of animals to the superior retrosternal lymph-nodes at the junction of the first rib and the sternum in five minutes. The writer has conducted similar experiments fifty or more times and has found that not only does India ink and fine lampblack reach these distant lymph-nodes (Fig. 2) from the pelvic fossa with this remarkable speed, but in some instances reaches the bronchial lymph-nodes as well. There seems to be no doubt, therefore, that there exists a prompt lymphatic absorption from the peritoneal sac by certain lymph-vessels which carry the absorbed material as far as the superior retrosternal lymph-nodes.

The path followed by this absorbed material in migrating from the pelvic fossa to the superior retrosternal lymph-nodes is more difficult to demonstrate. MacCallum's study (*vide supra*) was concentrated upon the double-layered cellular membrane constituting the diaphragmatic mesothelium and the lymphatic wall, through which the absorbed agents must pass in order to leave the peritoneal sac and enter the lymph stream. His conclusions were, that phagocytosis played the primary part in this transmigration and that a certain small percentage of the material might pass free through a loosely constructed intercellular substance into the lymphatic lacunæ. With these conclusions of MacCallum in mind, namely, the predominance of a phagocytic agency in the emigration of such agents as carbon through the peritoneum covering the diaphragm, and those of Muscatello and Buxton and Torrey, relative to the remarkably rapid dissemination of such foreign agents to the retrosternal lymph-nodes, the writer proceeded to study not only the peritoneal mesothelium but the paths taken by the carbon after it had penetrated the peritoneum, at all possible points from the peritoneum to the retrosternal glands. From 3 to 5 c.c. of a suspension of artist's special moist lampblack in salt solution were injected into the lowest point possible of the peritoneal sac of guinea-pigs. After vary-

ing periods of time the animals were killed and the diaphragm, superior retrosternal lymph-nodes, mesenteric nodes, and portions of the pelvic and abdominal parietal peritoneum were removed.

The microscopic investigations included the study of tangential sections of the abdominal surface of the diaphragm at various points of the muscular edge and tendinous centre, similar sections of the pleural surface of the diaphragm, and cross-sections from each of several areas. From these sections, photomicrographs are selected and presented herewith to illustrate the conditions found. Examination of the unsectioned peritoneal surface of the diaphragm with binoculars shows the particles of carbon to be gathered in smudges over its entire surface and attempts to either wash it off or otherwise remove it demonstrate its firm adhesion to the glistening peritoneal surface. Tangential celloidin sections of this abdominal peritoneum show, as MacCallum says, a number of carbon particles within leucocytes, but in periods of less than ten minutes after injection, the greatest quantity of carbon by far is to be seen free within the peritoneal cells and in the lacunæ. At points other than where the lucunæ appear (Fig. 3), the carbon, having penetrated the peritoneal mesothelium, is seen in the endomysium among the muscle fibres. In these endomysial trabeculæ the lymphatics of the diaphragm are known to run and in section they are seen to divide and join again, forming a network of carbon-containing tissue tracts over the whole diaphragmatic musculature.

In cross-section at any point in the diaphragm the carbon is seen to (Fig. 4) penetrate the peritoneal mesothelium and follow the endomysial channels from one side of the diaphragm to the other. Tangential sections of the pleural surface of the diaphragm present here and there (Fig. 5) large lymphatic radicals running just under the pleural mesothelium filled with carbon particles.

With the assistance of Prof. Adam Miller of the Department of Anatomy, the writer next attempted to inject the lymphatic radicles of the diaphragm with India ink by means of a fine glass cannula used by him in his vascular injections of the chick embryo. The ink when deposited under the mesothelium of the abdominal side of the diaphragm always followed fine parallel lines corresponding to the long axes of the tendinous and muscular fibres. When these lines are compared with the tangential sections (Fig. 3) they are seen to be the endomysial tracts which have been shown microscopically as the paths taken by the absorbed carbon.

After these injections under the peritoneal surface of the diaphragm a few distinct beaded lymphatic radicles appear on the pleural surface,

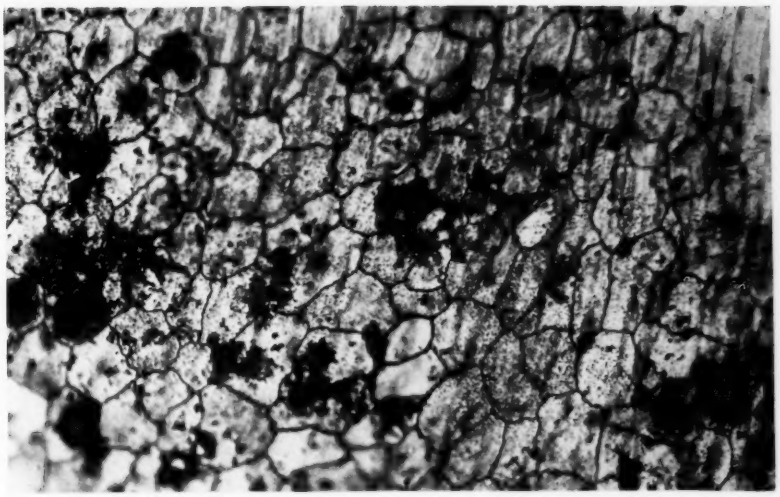


FIG. 1.—Tangential protargol impregnated section of diaphragm after injection of 3 c.c. of carbon. No stomata; carbon in smudges. (Photo. 450 diams.)

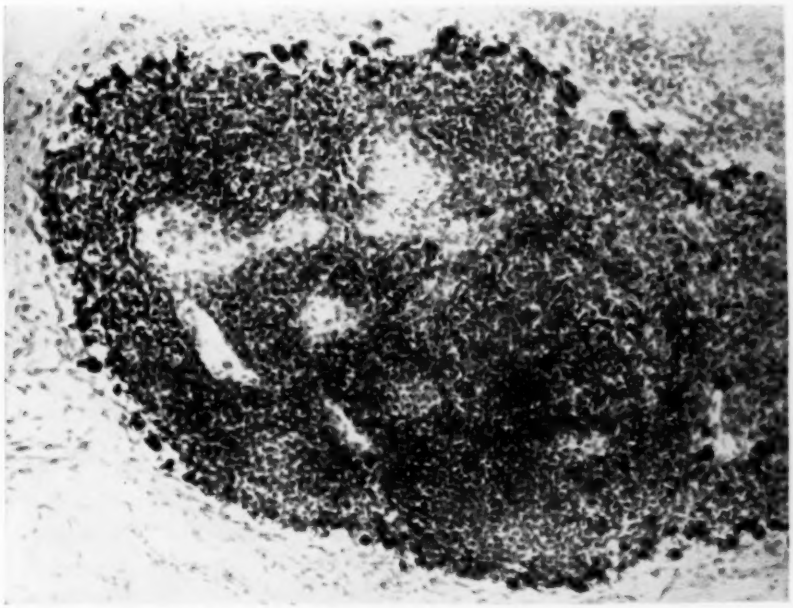


FIG. 2.—Superior retrosternal lymph-node, guinea-pig, five minutes after injection of 3 c.c. of carbon in pelvic fossa. Carbon in afferent sinuses. (Photo. 375 diams.)

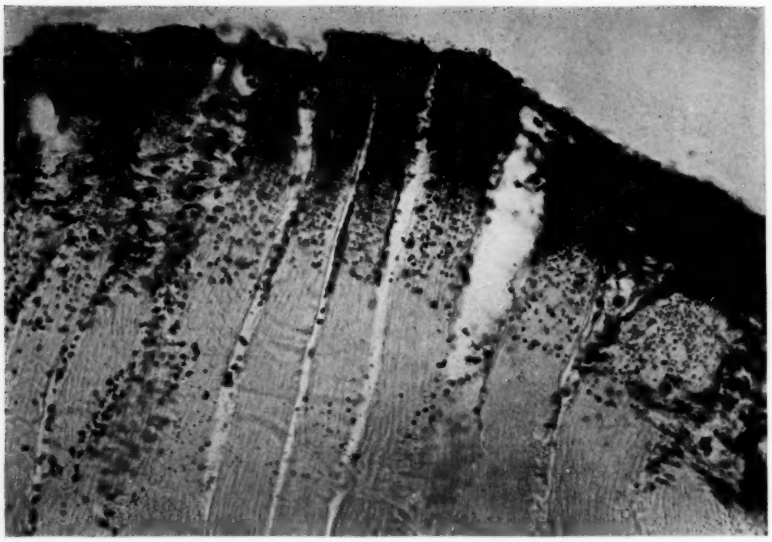


FIG. 3.—Tangential protargol impregnated section of peritoneal surface of diaphragm, showing carbon in endomysial channels.

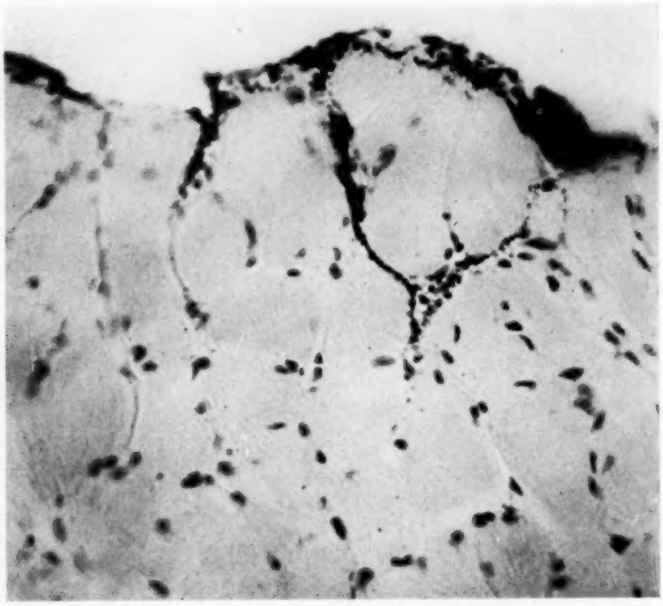


FIG. 4.—Cross-section of diaphragm, showing carbon five minutes after injection penetrating well into endomysial channels from peritoneal surface. (Photo. 400 diams.)

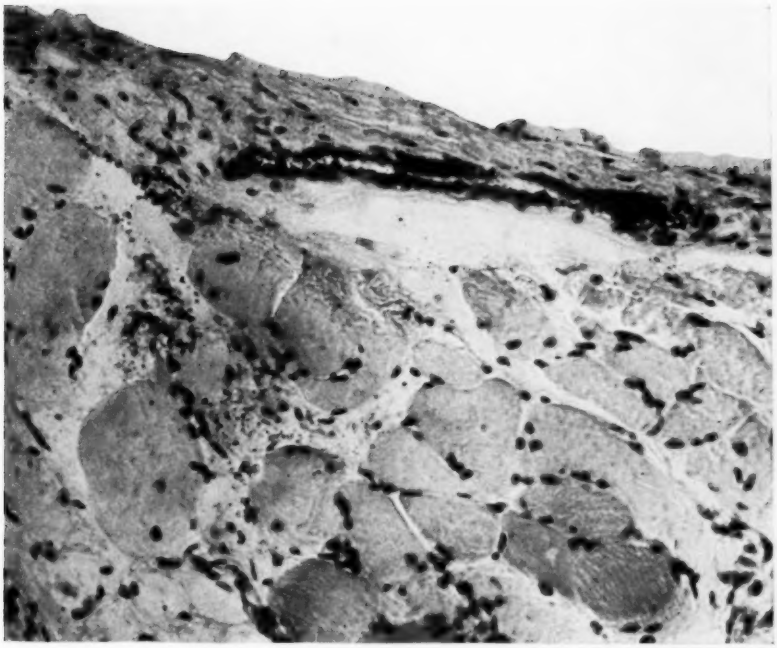


FIG. 5.—Cross-section, pleural surface of diaphragm, showing lymphatic filled with carbon five minutes after injection and carbon collecting in endomysial channels near pleural surface. (Photo. 300 diams.)

coursing from the muscular and tendinous portions to the ensiform attachment. Similar radicles rapidly carried the ink from the region of the liver up through the falciform and to the costoxiphoid glands of Sappey. Attempted retrograde injection of the retrosternal lymphatic chain from the superior retrosternal glands to the ensiform and diaphragm failed apparently on account of valves in the lymph-vessels.

Question 3: The observations made by Muscatello and Buxton and Torrey already referred to, verified and amplified by the writer, made practically positive the belief that a direct lymphatic absorption does take place from the peritoneal sac. Recently the question of hæmatogenous *versus* lymphatic absorption from the peritoneal sac has been brought forward in a report by Dandy and Rountree, ANNALS OF SURGERY, April, 1914, in which a general denial of any considerable lymphatic absorption was made. Without occupying space by going into details as to possible physico-chemical errors consequent upon drawing conclusions from a comparative test of the time of appearance of sulphone-phthalein in the urine and in the thoracic duct, the following points may be noted:

Wells and Johnstone (*J. of Infec. Diseases,* 1907, vol. iv) have successfully attempted to show that bacteria do not pass into the blood-vessels of the general peritoneum but reach the blood wholly by way of the lymphatic vessels. In order to approach the conditions active where fluids are to be absorbed from the peritoneal sac, the writer injected with the same technic used for carbon, 3 c.c. of a 0.1 per cent. solution of trypan blue. The animal was killed immediately and in the short space of time necessary to remove the superior retrosternal lymph-nodes, namely, two minutes, these were found a deep blue color.

Time had not elapsed for any general diffusion of the dye and we feel justified in concluding that it had travelled from the pelvic fossa by the same channels as the absorbed carbon.

Question 4: In all the carbon and trypan blue experiments various specimens of tissue that had been directly bathed in the injected solutions, namely, the parietal peritoneum other than that of the diaphragm, the visceral peritoneum and the mesenteric glands were investigated microscopically for evidence of absorption at these points and none was found. From the peritoneal sac, therefore, solid particles of carbon, living and dead microörganisms, chicken blood-corpuscles and saline solutions of trypan blue are seen to be absorbed definitely by lymphatics which, having their origin in the diaphragm, stream past the superior retrosternal lymph-nodes and in such short space of time as

to prove this absorptive path one of definite and prompt activity whether a coincident hæmatogenous absorption takes place or not.

Carbon injected under the visceral peritoneum regularly followed definite lines to definite neighboring lymph-nodes and in one instance, where the cæcum was especially infiltrated, a gland taken from the region of the duodenal curve near the pancreatic head was found full of carbon.

Incidentally the rapidity with which fluids are removed from the peritoneal sac under normal conditions of circulation was noted in the first place by the remarkably small residue of 10 c.c. of carbon solution that could be found in the peritoneal sac twenty-five minutes after injection; and in the second place by observation made in the rabbit, when two drachms of the animal's blood was allowed to flow from a mesenteric vein into the pelvic fossa and, without further damage to the peritoneum, the abdomen closed. In twenty-four hours all that could be found of the two drachms of blood was a small speck of pinkish fibrin, which consisted microscopically of a few leucocytes and a few strands of hæmoglobin stained fibrin.

*Conclusions.*—1. Absorption of certain solid foreign material injected into the peritoneal sac occurs with marked rapidity, first by a process of translocation through the cells of the diaphragmatic mesothelium and later through the agency of leucocytes.

2. That such solid foreign material having passed the peritoneal mesothelium is conveyed through the endomysial tracts throughout the diaphragmatic musculature to the lymphatic radicles on the pleural surface of the diaphragm, from these through the various diaphragmatic gland groups to the costoxiphoid glands of Sappey, and from thence through the retrosternal chain of lymphoid tissue to the subclavian vein or thoracic duct.

3. That certain fluids injected into the peritoneal sac follow the same lymphatic absorption lines, whether they coincidently enter the blood stream directly or not.

4. That the tissues of the diaphragm take a distinctly active part in absorption from the peritoneal sac and that other areas of parietal peritoneum functionate little if any in the lymphatic absorptive process.

5. That the post-operative postural treatment of pelvic peritonitis as advocated by Fowler has definite pathological foundation.

The author's gratitude is here recorded, for the friendship that prompted the assistance given him by Prof. W. C. Clark, Adam Miller and Dr. John C. McWhorter.

# THE PREVENTION OF POST-OPERATIVE ADHESIONS IN THE PERITONEAL CAVITY*

By Joshua Edwin Sweet, M.D., R. H. Chaney, M.D.
and
H. L. Willson, M.D.
of Philadelphia
(From the Laboratory of Surgical Research, University of Pennsylvania)

The problem of checking or limiting intestinal adhesions following abdominal section is of such great practical importance that it has stimulated many suggestions for solution. It was considered advisable to undertake an experimental comparative test of some of these methods which have been advocated. The work was carried out upon dogs which were at the time of operation under complete surgical anæsthesia with ether, and which received both before and after operation the best possible care. In all operative work the strictest methods of asepsis were employed, such as are used in the operating rooms of modern hospitals.

The first work, done in a measure for a control series, was simple intestinal anastomosis. In these cases the abdomen was opened by midline incision about three inches in length, extending upward from the umbilicus. The gut was drawn out through the wound, protected by gauze pads, a section removed, and an end-to-end anastomosis performed. The gut was then returned to the abdominal cavity and the wound closed by the layer method. In all the following work the same type of incision was used, and the same method of closing the wound.

Two cases of simple end-to-end anastomoses were done. These animals were killed by gas at the end of six and eight weeks respectively. In both cases the abdomen was free from adhesions, the gut normal and no signs of peritonitis were present.

The next experiment in the series was performed to see what the effect of covering the operative area with an attached portion of omentum would be. In these instances two end-to-end anastomoses were performed on the same intestine, the first being left free without covering; the second being covered with the free border of the omentum. The omentum was carefully wrapped over the site of operation and held in position by a couple of silk stitches. This dog was killed and

* Read before the Philadelphia Academy of Surgery, November 2, 1914.

autopsied three weeks after the operation. The abdominal cavity was free from exudate or any indication of peritonitis, and free of adhesions, save for the point at which the omentum had been attached to the site of anastomosis at the time of operation.

The next two dogs operated upon were treated in a similar manner with the intention of observing the effect of free omental and mesenteric grafts in the prevention of adhesions. In all of these cases three anastomoses were made—one left free without covering; one covered with a free piece of omentum, while the last was covered with a free piece of mesentery.

The strip of omentum was taken from the lower free border—the raw surface of the omentum being closed with a fine silk ligature. The strip of mesentery was taken from the redundant mesentery left after the removal of a section of the bowel. The grafts were held in place over the points of anastomosis by a few fine silk sutures.

In the first dog—autopsied two weeks after operation—the free uncovered anastomosis was the site of a few but rather dense adhesions, while both of the covered areas—the one being covered by omentum and the other by mesentery—were absolutely free from adhesions. There was no sign of peritonitis, adhesions about the free area being simply due to the attachment of the omentum to that area.

In the second dog, autopsied one week following operation, there was no trace of adhesions or peritonitis. In each case there was no free fluid in the abdominal cavity.

Following these experiments studies were undertaken concerning the effect of liquid paraffin in checking adhesions. In these cases some ten minutes before opening the abdomen, 100 c.c. of sterile paraffin oil was injected into the abdominal cavity by means of a large syringe and needle. This apparently large amount of oil was used because of the fact that during the operation a considerable amount of the oil would overflow through the wound.

The reason for the injection of the oil into the abdomen previous to operation was that the entire peritoneal surface would become thoroughly coated with a film of oil before being exposed to the air. All sponging at the time of operation was done with gauze saturated with the sterile oil. Four dogs were employed in this series, the operation in each case consisting of two end-to-end anastomoses. In each case, as will be noted later, there was an extensive exudation of leucocytes into the abdominal cavity. Because this exudation was so great, it was examined under the microscope and the granularity of the cells and their apparent fragmentation led us to believe that their functional

power as phagocytic agents might be diminished. The following method was adopted in the last two cases of this series, and in some of the cases of the following series, to test this phagocytic activity. Immediately after the abdomen was opened at autopsy about 25 c.c. of the exudate there found was collected in a sterile flask. This was then mixed with an equal amount of sterile, warm saline solution and centrifuged. This resulted in the throwing down of a considerable portion of the leucocytic cells which were again collected and rewashed until the leucocytic cream was freed from oil and of a uniform consistency. In these cases the animal was killed by ether and just before death the carotid artery was opened and 50 c.c. to 75 c.c. of blood obtained. This was defibrinated and centrifuged; a portion of the serum was decanted and placed in an incubator until the washing of the cells was complete.

The leucocytes from the blood were then washed simultaneously with those from the abdominal exudate, both samples of leucocytes being thus treated in the same manner so that there should be no difference in their activity because of variation in the mechanical manipulation. These two samples of leucocytes—one obtained from the exudate in the peritoneal cavity, the other from the blood of the same animal—were mixed with the blood serum from the same animal and a bouillon suspension of *Micrococcus aureus* in the proportions commonly used in obtaining the opsonic index for the blood serum, and incubated for half an hour. The leucocytes were the unknown factor in these cases and not the serum. The ratio of the number of bacteria taken up by the leucocytes from the abdominal exudate to the number of bacteria taken up by the leucocytes from the blood of the same animal is what we shall here call the phagocytic index of the given case.

The first animal died from a diffuse peritonitis nine days after operation. Autopsy showed no marked adhesions, though many fine fibrinous strands were adherent to the gut; the abdomen contained 125 c.c. of thick, oily and whitish exudate. The second animal was killed and autopsied ten days after operation. A local peritonitis was present about the operated areas with extensive adhesions matting the intestinal loops together, although these adhesions did not directly involve the operated areas; 200 c.c. of fluid was found in the belly, of the same character as that found in the previous case.

The third dog was autopsied seven days after operation, a general low grade peritonitis accompanied by fine plastic adhesions throughout the abdomen being found; 150 c.c. of the same characteristic exudate was present. The phagocytic index in this case was 3: 14. The fourth dog was autopsied four days after operation and an extensive exuda-

tion with large amounts of sticky, fibrinous material generally spread over the gut but unorganized was found; 200 c.c. of exudate was present. The phagocytic index in this case was 4: 15.

In considering the results in the foregoing experiments the question naturally arises as to whether the adhesions so constantly present were due to the presence of the oil or to some fault in technic. It was decided to inject the same amount of oil directly into the abdominal cavity and observe the result. In a series of three dogs 100 c.c. of sterile paraffin oil was injected directly into the abdomen by means of a large needle and syringe—the animals then being killed at intervals. The first dog, autopsied four days after injection of oil, showed exudate amounting to 200 c.c. with fine plastic adhesions throughout the abdominal cavity; the phagocytic index was 4: 16. The second dog was autopsied eight days after the injection of oil, showed 125 c.c. of exudate and many plastic adhesions binding the gut generally in a mass; the phagocytic index was 3: 17.

From the third dog, autopsied twelve days after injection, 160 c.c. of exudate was recovered and dense adhesions were found binding the gut into so firm a mass that it was impossible to separate the adhesions without tearing the serous surface; the phagocytic index was 0: 16.

Because of the unsatisfactory results in our experiments thus far, it was decided to try in one case the injection of sterile olive oil. This was done in the same manner as before, the dog being autopsied eight days after the injection. Generalized adhesions throughout the abdomen were found, the exudate being extensive in amount. No attempt was made to determine the phagocytic index and nothing further was done with this substance.

At this time a question arose as to the purity of the paraffin oil used and, at the suggestion of Dr. Taylor, we determined to try the result of using glymol, a proprietary preparation, which he had found to be of a high grade of purity. This was used experimentally in three cases. In the first dog, the sterile oil was injected directly into the abdomen, no operative measures being employed. The animal was killed and autopsied three days later. The results were other than we had expected from our former work with paraffin oil. In this case only 80 c.c. of the oil had been injected because of the small size of the dog. At the autopsy only 60 c.c. of exudate was found in the abdominal cavity, the exudate presenting a clear, homogeneous appearance.

The leucocytes under the microscope appeared normal and the phagocytic index was 8: 10. The gut was normal in appearance and no trace of adhesions was present. Because of this apparent good

result, the operative measures used in the earlier cases were again resorted to. In the second series, 110 c.c. of sterile glymol was injected into the abdominal cavity before making incision. The gut was carefully protected and all sponging done with gauze saturated with the oil. Two end-to-end anastomoses, as in the former instances, were performed. The animal died thirteen days later from peritonitis; 250 c.c. of exudate was found in the cavity. Marked plastic adhesions binding the entire gut together were present, also a localized abscess at the lower point of anastomosis. Cultures from the fluid in the general abdominal cavity were sterile. The peritoneum was generally opaque. The last dog of this series was handled in the same way, save that only 90 c.c. of glymol was injected previous to operation. At autopsy, four weeks later, adhesions to the abdominal wound and around the operative site were found. A general fibrinous peritonitis of low grade was also apparent and small fat or oil droplets could be seen in the broad ligaments and omental lymph spaces. The exudate was 25 c.c. in amount and of the same character as found in cases where paraffin oil had been used. The few leucocytic cells present showed marked granular change and the phagocytic index was 0: 12.

While still working on the use of oils, it occurred to us, as we were bleeding a dog into citrate solution, that if citrate prevented the normal ferment action in blood whereby fibrinogen was changed to fibrin, the same might hold true if the solution were placed in the abdomen after operation, thus limiting the formation of adhesions. This would, however, seem to be an attempt to limit a function which is normally necessary in the repair of serous surfaces. Adami distinctly states in dealing with the process of healing of serous inflammation that the first step in the process is the outpouring of an uncertain amount of plastic lymph which tends to glue the surfaces together, later to become organized and remain as scar tissue. Thus, if the formation of this plastic lymph were prevented would not the liability of infection passing from intestinal tract to peritoneum be increased, especially in cases where the gut had been opened? Our attention to this mode of dealing with adhesions was further stimulated by the results which Pope published in the ANNALS OF SURGERY, reporting the use of citrate solutions in checking adhesions in rabbits in cases where the peritoneum was simply scarified, though the gut was not opened.

To gain some personal evidence, citrate solutions were employed in seven cases in the following manner. As before, end-to-end anastomoses were performed in two sites with the same aseptic care as before, but

just before closing the abdomen 50 c.c. of a 3 per cent. sodium citrate solution in normal salt solution was emptied into the cavity.

The major thing noted at the time of operation was that, even with this small amount, it was extremely hard to keep the solution from running slightly over the edges of the abdominal wound. This caused a very marked oozing in each case, making the closure of the wound more than normally difficult.

The first dog of the series, autopsied two weeks after operation, showed imperfect healing of the abdominal wound, a gap into the deep tissues at least three-eighths of an inch being present at one end. Inside there were extensive adhesions of the omentum to the gut about the operative areas and some adhesions were present between the adjacent loops of intestine. Only a very small amount of fluid was present, a culture from which gave what appeared to be pure colon bacillus growth. In the second dog of the series, autopsied a week after operation, while the peritoneal edges of the wound were healed, the skin and fascial layers were imperfectly healed. Within the abdomen adhesions were present both of the omentum to the gut and of the adjacent loops of gut. In the third member of the series the abdominal wound split open on the third day after operation and the dog had to be killed. The fourth dog died from general peritonitis four days after operation, two local abscesses being present near the operative points. The fifth, sixth and seventh members of the series, autopsied fourteen, nine and seven days after operation respectively, presented similar pictures. General adhesions were present of the omentum to the gut in the neighborhood of the operative areas, and adhesions were present between the adjacent loops of intestine to a considerable extent. In none of these cases was distention noted nor was fluid found within the cavity. In no instance was there perfect healing of the abdominal wound, a distinct contrast with the former cases.

In discussing the above results we note that in five cases where no other means than simple careful technic and covering of the operative area with omentum or mesenteric strips were used, adhesions resulted in only one case, this being one where adhesions were found to the uncovered area, the covered areas in the same case being free. In eleven cases where some type of oil was used in the endeavor to limit adhesions, these were formed in nine cases. In one of the cases where adhesions were absent peritonitis caused the death of the animal, only a single case being free from adhesions or peritonitis. In all of the eleven cases more or less extensive exudation was present. In seven out of the eleven cases in which oil was used the phagocytic index was

tested, and in all save the first experiment with glymol the index was markedly reduced, and even in this case it was not normal. This is shown more markedly by the accompanying chart, a study of which shows that in no case was the index higher than 8: 10, once as low as 0: 16, while the average index was about 4: 17. From this work it can be deduced that oil in any form causes an intense exudation of leucocytes into the abdomen and these are inhibited from their normal physiological function by the presence of the oil, as indicated by the low phagocytic index. Thus it can be stated that oil is contra-indicated, if for no other reason than that anything which causes local migration of these cells and then checks their action simply increases the bulk of foreign material with which the tissues have to deal.

| Substance Injected | Amount Injected | Amount of Exudation | Phagocytic Index | Time Autopsy |
|---|---|---|---|---|
| | *c.c.* | *c.c.* | | *Days* |
| Paraffin oil..... | 100 | 150 | 3: 14 | 7 |
| Paraffin oil..... | 100 | 200 | 4: 15 | 4 |
| Paraffin oil..... | 100 | 200 | 4: 16 | 4 |
| Paraffin oil..... | 100 | 125 | 3: 17 | 8 |
| Paraffin oil..... | 100 | 160 | 0: 16 | 12 |
| Glymol..... | 80 | 60 | 8: 10 | 3 |
| Glymol..... | 90 | 25 | 0: 12 | 28 |

Another interesting fact in respect to oil is noted in that during the first four days following the injection of oil there is an excessive amount of exudation of fluid into the cavity, then in the next four days there seems to be a decrease in the amount of fluid, followed in the last four days of a twelve-day period by again increasing amounts. The explanation of this, of course simply a theory, is that the presence of the oil in the abdomen primarily calls forth an intensive cell exudation. In the process of adjustment absorption begins and the amount is temporarily decreased, but as soon as absorption begins, the lymphatics become plugged with oil and cell detritus and the further increase in the exudation is held within the cavity. This condition then remains for a long period, extensive exudation being present three weeks to a month after operation. That the oil is gradually absorbed by the lymphatics is shown by the presence of oil droplets in the lymphatics of the mesentery and broad ligaments in cases allowed to go for a long period.

From our experiments with the use of citrate solutions involving seven cases, there is not a single satisfactory result. Two deaths

occurred, one resulting from peritonitis, the other from the splitting open of the abdominal wound.

In all the other cases, five in number, the results are surprisingly similar, adhesions being noted in all instances, while a minor grade of peritonitis was present in one. In none of these cases was there satisfactory wound healing. This would certainly contra-indicate the use of such solutions in clinical work. Our results with the use of citrate solution in dogs are just opposite from the results which Pope obtained with the same solution in rabbits; in his work adhesions were limited and wound healing normal.

This we take to be due to the fact that we were working in areas where the gut had to be opened, thus exposing the area to the chance of infection, a factor not to be unconcernedly thrown aside. It is also probable that this procedure limits the normal production of plastic lymph so that seepage takes place through the lines of intestinal sutures, and a minor degree of infection follows which results later in the production of adhesions, though there is not enough infection present in all cases to give a definite peritonitis. The disagreement of our results with those of Pope's may be due to the fact that he did his work on rabbits, the peritoneum of which is generally known to be very resistant to infection, and that he was working under the artificial condition of the exclusion of possible infection. While we are not inclined to draw final conclusions, we would say that citrate solution is not indicated in cases where infection may be present, though it may have a field in those cases where infection can certainly be excluded; we would call attention in such cases, *i.e.,* where the adhesions are broken up without opening a certainly infected area—such as an abscess or the intestine—to the great danger which would follow if a focus of even mild latent infection were opened in the presence of a citrate solution. This statement is based upon the experimental evidence that the first step in the removal of infection from the peritoneal cavity consists in a gluing of the bacteria to the omentum—a process with which the citrate would certainly interfere.

These conclusions are almost identical with those reached by Momburg after using injections of oil in 16 clinical cases. Coffey also has lately expressed the same views in the use of oil.

The process underlying the formation of adhesions is a part of the process of the normal repair of all wounds of serous surfaces consisting, as pointed out above, in the outpouring of a plastic lymph which seals the lips of the wound. The problem therefore is not the prevention of adhesions, but the limitation of adhesions; if the outpouring

of this plastic lymph be entirely prevented, the wound is not sealed and the entrance of bacteria from the intestinal lumen into the peritoneal cavity is unhindered.

This problem of limiting adhesions therefore becomes the somewhat delicate problem of permitting the necessary adhesions and preventing the unnecessary ones. It does not seem to us that this delicate line can be drawn by the use of any chemical or physical method such as citrate or oil, and we return to the point so often reached by the surgeon, after some new idea has fostered false hopes, that all wounds of the peritoneum must heal by a process of lymph formation, which when carried too far means adhesions; therefore the only method of limiting adhesions is to limit the wounds of the peritoneum. The results of the work we here report show that this can be done by careful technic and by covering the necessary wounds with freed or attached portions of the omentum or mesentery.

The most practical method for limiting adhesions consists in the clear understanding of the operator that the peritoneum is not a structure which can be cut and sewn, but a single layer of delicate endothelial cells; that the biologist obtains these cells for study by gently wiping the peritoneal surface with a gauze sponge, then pressing this sponge on a cover glass; and that every wound of this layer of cells begins to heal by the fundamental process of adhesion formation —the outpouring of a plastic lymph.

# THE TECHNIC OF CHOLECYSTECTOMY*

By Edward Starr Judd, M.D.
of Rochester, Minn.
(Mayo Clinic)

The two great dangers in removing gall-bladders are hemorrhage from the cystic artery and injury to the common bile duct. Hemorrhage may occur at the time of operation or may come later from slipping of a ligature. Injury to the duct may occur through clamping off the cystic duct too closely or, more commonly, through efforts to stop bleeding from a cystic artery which has slipped while being ligated.

Cholecystectomy is best accomplished from below upward. The important reasons for this are that the dissection from below upward is easier, and the circulation is controlled at the start. It is essential to know the condition of the common duct, head of the pancreas, and lymphatic glands before removing the gall-bladder and, in the dissection that exposes these, the cystic duct is freed.

*Step I.*—The abdominal incision instead of being made over the normal location of the gall-bladder is made high and close to the midline, usually extending to the ensiform. Through this high incision, in most cases, much of the right lobe of the liver can be rolled out by using the gall-bladder as a tractor. If the liver is adherent to the parietal peritoneum, the adhesions should be freed before proceeding further, as the operation is much simpler if the liver can be displaced.

*Step II.*—An assistant gently tracts on the pair of forceps which is caught tc the fundus of the gall-bladder. The neck of the gall-bladder is then caught with a second pair of forceps and this part of the gall-bladder and the cystic duct are pulled away from the surface of the liver. Considerable fat and œdematous tissue may be encountered in this region, especially if there is an empyema of the gall-bladder; but this fatty tissue can be cleared away from the duct by a blunt dissection. Tracing down the cystic duct as a guide, the common duct is usually readily exposed by this traction on the neck of the gall-bladder. The neck of the gall-bladder and the lowest part of the body of the gall-bladder frequently lie alongside the cystic duct, so that when this is dissected out and pulled up the cystic duct is easily separated from the surface of the liver (Figs. 1 and 2).

* Submitted for publication, December 2, 1914.

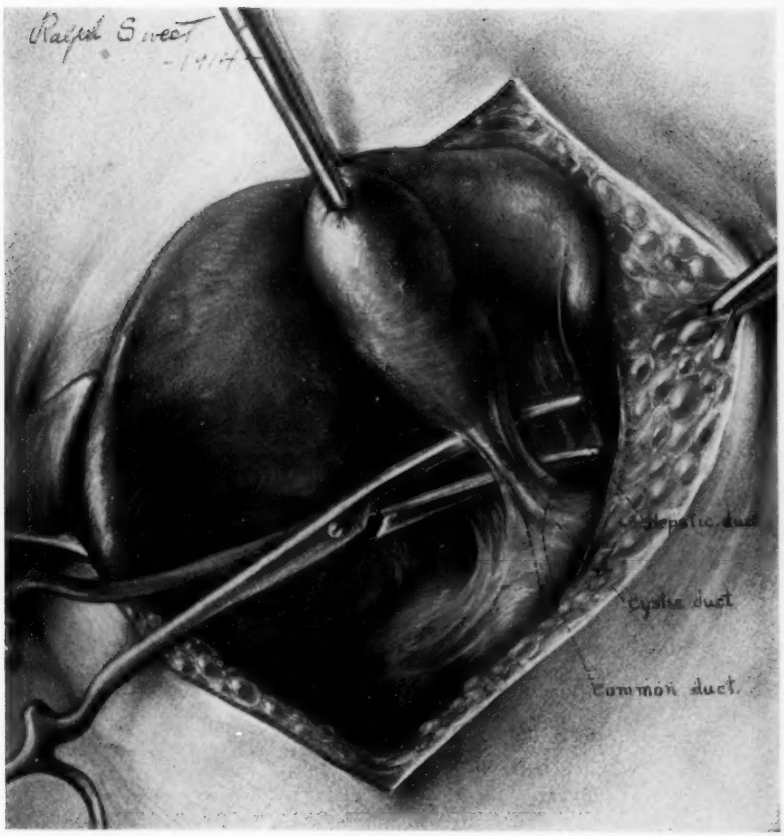



FIG. 1.—High abdominal incision extending to ensiform if necessary. Grasping gall-bladder fundus in soft clamps, the liver is rolled out in the usual way. An additional clamp may be put on the gall-bladder near the cystic duct to tract the gall-bladder and cystic duct away from the liver, so that by blunt dissection the cystic duct and artery are separated from the surrounding tissue.

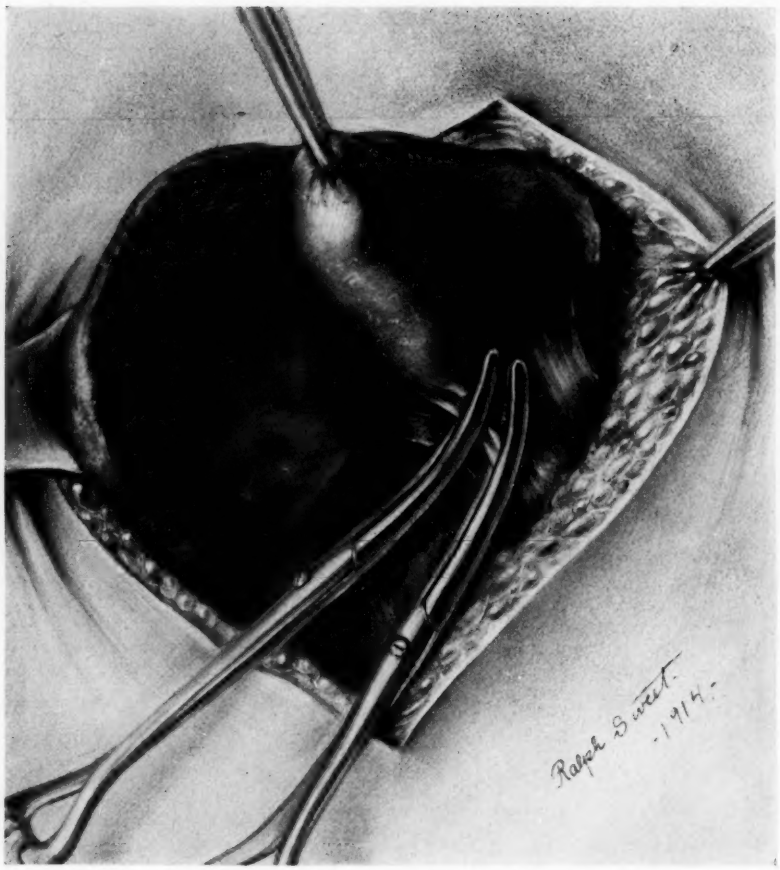



FIG. 2.—Isolated cystic duct with vessels is clamped away from common duct.

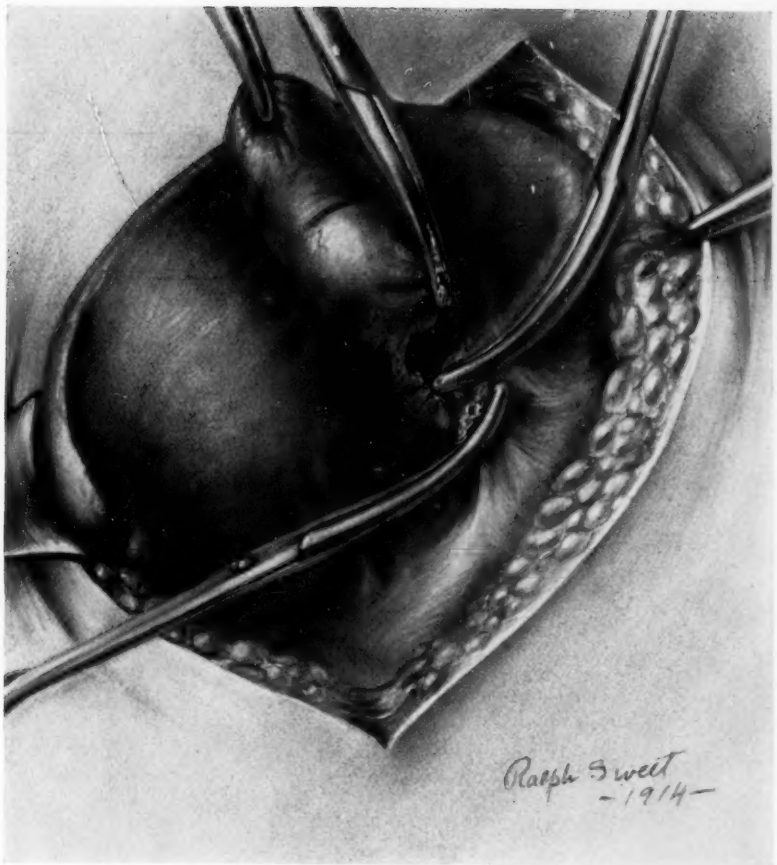



FIG. 3.—Cystic duct severed between clamps. Gall-bladder turned out. One clamp under the cut-off end of the gall-bladder catches any little vessels not included in the clamp on the cystic duct.

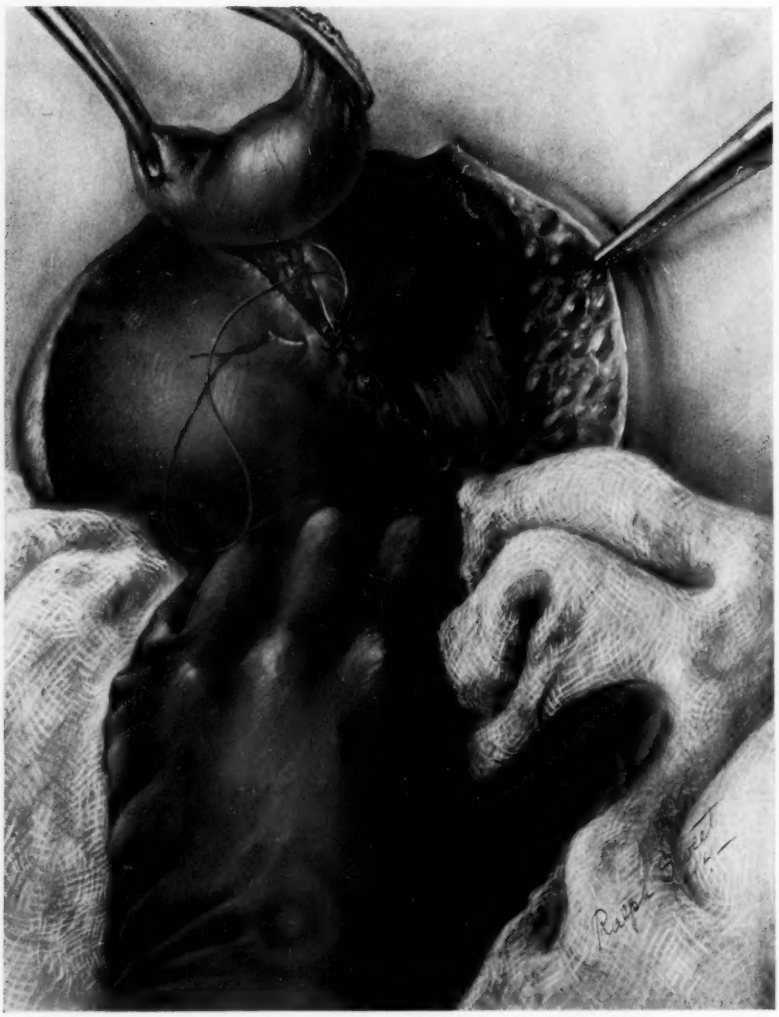


FIG. 4.—Gall-bladder dissected out in the usual way and fissure in the liver sutured.

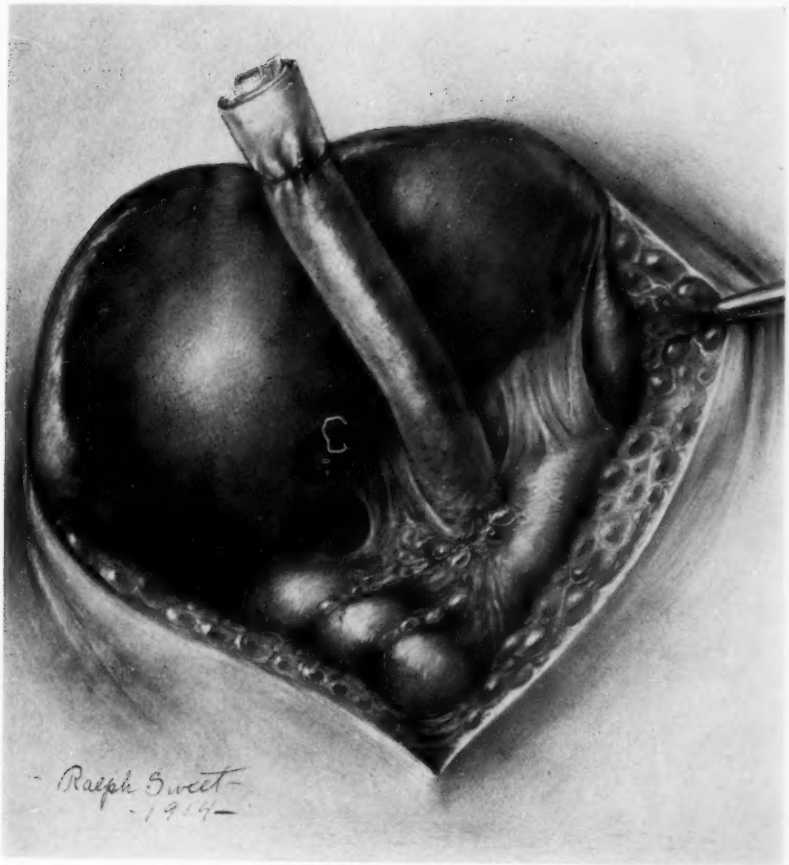



FIG. 5.—Drain down to cystic duct.

*Step III.*—The cystic duct and cystic artery are kept together. After these are completely freed from the surrounding tissues for the distance of a half inch to an inch they are caught together in two clamps and divided between the clamps. It is this particular step in the technic that I wish to emphasize. If the dissection at this point is carried out as described, the cystic artery is definitely ligated without tension and the common duct cannot be injured because the grasp of the forceps includes nothing but the cystic duct and artery.

*Step IV.*—After dividing the duct and vessels between clamps, the end of the gall-bladder just cut off from the duct is pulled upward with a little tension, thus exposing the peritoneal folds and the communicating vessels at this point. These vessels are caught and the gall-bladder is dissected from its attachments to the liver (Fig. 3).

*Step V.*—The stump of the cystic duct and the cystic artery are now ligated with one ligature of ordinary catgut. It will be noted that this is done before the gall-bladder has been entirely removed. This attached gall-bladder makes an ideal retractor and traction on it gives good exposure for the ligation of the duct and artery. As soon as these structures are ligated, the ligature is cut and they are allowed to drop back free from the liver.

*Step VI.*—A suture is now started through the cut edges of the peritoneal folds from which the neck of the gall-bladder has been removed. This is continued upward to the edge of the liver and is made to cover as well as possible the raw surface left on the liver. The gall-bladder is removed a little at a time and then a few stitches applied. If there is oozing from the surface of the liver, one or two extra stitches may be necessary, though usually a little pressure and relaxation of tension will control it (Fig. 4).

*Step VII.*—A small cigarette drain is placed down to the cystic duct and brought out so it will lie in the fissure from which the gall-bladder was removed (Fig. 5).

This technic does not vary in many essentials from that often described. The important step in the operation is the complete freeing of the cystic duct before it is cut. Sometimes this is difficult, though it can be done in practically every case.

# SOME EXPERIMENTS ON THE SURGERY OF THE PANCREAS*

By Joshua Edwin Sweet, M.D.
and
I. H. Simons, M.D.
of Philadelphia

(From the Laboratory of Surgical Research, University of Pennsylvania)

In 1909 Coffey[1] published a series of experimental operations designed to prepare a new exit for the external secretion of the pancreas applicable to cases in which the pancreatic ducts are occluded because of some pathological process in the head of the organ. The pancreas is not infrequently attacked by the pathological processes common to such glandular structures, notably benign and malignant tumor growths and by inflammation; the diagnosis of these conditions has made noteworthy progress, but the actual surgery of the pancreas seems to be limited to either indirect drainage through the gall-bladder, or, more rarely, direct drainage of the gland. The laboratory worker has little respect for the pancreas, and the fact that so much of our knowledge concerning the function of the organ is based on the experimental surgery of physiologists justifies the thought that the pancreas is able to withstand as much surgical maltreatment as any other vital organ.

Our studies were undertaken at the suggestion of Dr. Edward Martin without at first a knowledge of Coffey's previous work. Our conception was far more simple than the extended and elaborate procedure of Coffey, and our results seem worth communicating, because they fully support Coffey's conclusions concerning the surgical possibilities of the pancreas and because they offer a technic so simple that it could be executed with a trivial loss of time.

The condition in which such an operation would be indicated is in general that of a blocking of the pancreatic duct; in particular as seen in (1) carcinoma of the head of the pancreas; (2) carcinoma of the ampulla of Vater and the lower part of the common duct; (3) adenoma and chronic interstitial pancreatitis of the head of the pancreas; (4) cysts of the head.

---

* Read before the Philadelphia Academy of Surgery, November 2, 1914.

[1] Coffey, Annals of Surgery, 1909, i, 1238.

The ducts of the pancreas are valveless. The direction of flow of the pancreatic juice can be reversed in the larger ducts, as is seen in the attempts to form a permanent pancreatic fistula in the dog. The pancreas of the dog always possesses two ducts opening into the intestine, a major duct, opening apart from the bile duct and draining the greater part of the organ, and a minor duct, opening at or near the ampulla of Vater and draining an independent island of tissue, but both systems anastomosing, so that a cannula placed in the major duct will not supply the investigator with pancreatic juice unless the minor duct be tied.

The pancreas of the dog corresponds in a general way to the human organ, with the addition of a process extending down the intestine from the head, called the processus uncinatus.

Our first experiments were to determine if a part of the pancreas could be separated from the remainder of the organ and successfully implanted in the gut. The processus uncinatus was cut off from the head of the organ, the duct in the proximal stump ligated, and the end of the uncinate process simply implanted in the intestine by dropping it through a longitudinal slit in the gut, which was then carefully closed by fine sutures. The best technic for this procedure appears to be in detail as follows: The pancreas is fastened to the intestine by a continuous suture placed about one-half inch from the cut end of the pancreas. This suture is carried around that half of the circumference which will lie beneath the organ, since that part is most difficult of access.

The intestine is then opened by a longitudinal slit, one-half of which wound lies within the area enclosed by this continuous suture. The pancreas is inserted into the lumen of the gut and the continuous suture completed about the remaining half of the pancreas, or in other words the technic corresponds to the first and fourth rows of sutures in a gastro-enterostomy. The three animals in this series were autopsied after six, five and four weeks. In all three cases the duct in the implanted portion was patulous and of normal size. In two there was no apparent atrophy of the pancreatic tissue. One had atrophied to one-third of the original size; microscopic study of the tissue showed no abnormalities. There was no fat necrosis, perfect anastomosis, and a very few adhesions. The other part of the pancreas was of course entirely normal.

In the second series of three animals an artificial obstruction was attempted by ligature of the ducts with implantation into the intestine of the proximal end of the pancreas after cutting off the uncinate process.

The first dog was autopsied after five weeks, and it was found that the new opening into the gut had closed, while a new duct had formed around the ligature of the major duct. The second dog died a week after the operation, from distemper pneumonia, and even in this short time a new duct had formed around

the ligature of the duct. The third dog, autopsied after five weeks, showed the same result—a new duct circumventing the ligature of the duct. None of these cases showed any gross changes in the organ, no pancreatitis, fat necrosis, or atrophy.

In the third series the pancreatic ducts were cut between ligatures and the omentum was interposed between the ends of the ducts in an attempt to prevent the re-formation of these ducts. The proximal stump, after excision of the uncinate process, was anastomosed with the intestine by the same simple procedure outlined above. This operation was tried in two cases which were autopsied four weeks after operation. The implanted duct was patulous. The ducts had not re-formed and there was no evidence of pancreatitis, nor fat necrosis, nor atrophy.

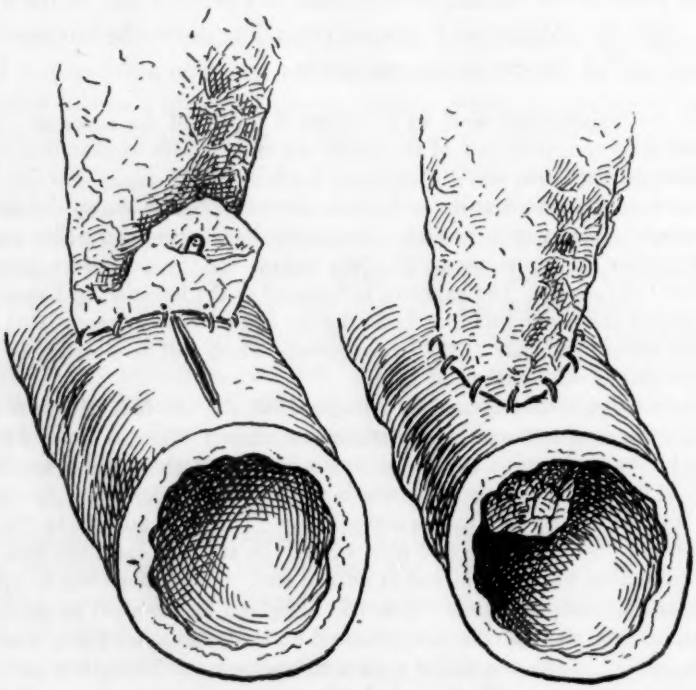


FIG. 1.—Diagrammatic representation of the method of inserting pancreas into bowel.

The persistency with which the pancreatic ducts reëstablished themselves in the second series, and the well-known digestive action of pancreatic juice on the edges of a fistula led us to vary our technic in the third animal of this series in that the cut end of the pancreas, after blocking the ducts by interposition of omentum, was implanted in an opening of the gut which extended simply to the mucosa. We wished to see, in other words, if the pancreatic juice would provide an opening for itself through the mucous membrane. This animal died at the end of a week, the autopsy showing acute necrotic pancreatitis with fat necrosis and occlusion of the duct at the site of implantation.

The results of experimental studies can be judged either on the basis of the perfect uniformity of the results obtained in a relatively small series, or on a percentage basis of a large series. The number of the experiments described here is small, but the results are so entirly uniform, if we disregard the last animal, in which because of the modification of technic an entirely new problem was introduced, that we may safely conclude, first, that the pancreas can be anastomosed to the intestine by a simple technic; second, that there is little probability of pancreatitis, with its immediate dangers or its final result of atrophy; third, that the new opening into the gut will functionate, provided the normal openings are effectively obstructed.

# A STUDY OF MULTILOCULAR CYSTADENOMATA OF RETROPERITONEAL ORIGIN

By Edward Staehlin, M.D.
of Newark, N. J.

Multilocular cystadenomata of retroperitoneal origin are of sufficient rarity (1907, five cases on record) to warrant the consideration of the following case. Moore,[1] in his masterly monograph, was the first to ascribe to growths of this nature their correct etiological classification. Before him the few cases that have been described were wrongly included under mesenteric or omental cysts, derived from some portion of the primitive omphalomesenteric duct, whereas the cysts under consideration are always of retroperitoneal origin ([2, 3, 4]).

Perplexing as it may be to correlate the structural characteristics, and the seat of the origin of these cysts, such correlation may nevertheless be reduced to a comparative simplicity, if we consider the embryological and anatomical relations of the genito-urinary system.

Moreover, when we consider that the fully developed embryo, to say nothing of its future development, derived its incipiency from a single cell, it seems as though it should be a comparatively simple matter to account for the origin and structural characteristics of the most complex cysts. We are all familiar with the early segmentation of the original cell into two original cell layers—ectoderm and entoderm —and how in rapid sequence from the ectoderm forms another cell layer—mesoderm—which latter forms so early as to be regarded until recently primordial with the ectoderm and entoderm. From these cell layers undergoes a most complete series of metamorphoses—a formation of all the different organs, a formation due to the inequality of growth of the different cells. Each cell layer assumes its distinct function of developing its respective highly individualized, succinct group of organs.

Consider now the wonderful metamorphosis the original cell undergoes; consider that the original layers are single cell layers, and consider the wonderful changes that they undergo; consider further what a single cell, let alone a group of cells, sooner or later might accomplish, when misplaced in course of their development, from one layer to another, and continuing to develop as an aberrant cell or group of cells—and you have an embryological conception of the incipiency of new growth formations of this class.

CASE REPORT.—*Clinical History.*—The patient, a male, sixty-one years old (1911), born in United States, brass founder, aside from two attacks of renal colic two and three years ago respectively, has always enjoyed good health.

Seven years ago, while being massaged in a Turkish bath, the masseur called his attention to a swelling in his abdomen situated to the right of the umbilicus, which he detected by accident. The patient then consulted a doctor who told him that the mass was as large as a good-sized orange and seemed freely movable, but inasmuch as it gave him no inconvenience he was advised to disregard it. Three years ago, while suffering from the first attack of renal colic, he was examined by another doctor, who incidentally examined this mass, and the patient was again advised to leave it alone, as its nature could not be determined, and as he was perfectly free from symptoms, though the mass had increased considerably in size. One year ago he was seen by a third doctor while in a second attack of renal colic, who also examined the mass casually and established the fact that in all probability it was an intra-abdominal mass of large size, but as the symptoms of renal colic had abated, the patient sought no further advice regarding the mass. These two attacks of renal colic were in the right side, the same side with the mass. During the past year this mass increased in size so as to become noticeable on the anterior aspect of the abdominal wall. It was to the right of the umbilicus and when palpated was smooth, convex, and in area it could be traced in expanse to the size of a child's head, when it disappeared in the hollow of the abdomen, was fixed, and the centre of convexity was in the waist-line over the right rectus; still there were no subjective symptoms other than an inconvenience when wearing a belt, half the mass would extend above and half below the belt, and the pressure caused by the slipping of the belt was the only inconvenience he had; on percussion there was flatness.

Seven A.M., August 30, 1911, while bending over to lace his shoes, he felt a sudden giving way in his abdomen with a disappearance of all signs of the mass. He reclined on a nearby couch, summoned a doctor, who in turn summoned me, and we together saw him within an hour after the accident. He was in a supine position, talked freely, absolutely no shock, pulse and temperature normal, and solicitous only of getting our permission to resume his day's work. By noon his pulse was 90, temperature 100° F.; at 8 P.M., pulse 100, temperature 100° F. He was somewhat irritable, had considerable pain all over his abdomen—a dull, constant pain. Next morning at 8 o'clock, pulse 100, temperature 100°. The attempt to move his bowels was ineffectual; at noon pulse 100, temperature 100.5°, there was some distention of the

abdomen, it was slightly tympanitic, except over the right rectus and flank, where there was dulness. At 4 P.M., pulse 116, temperature 101° F., the abdomen was more distended, the facial expression was anxious, no movement of bowels and no expulsion of flatus since his accident. The urine was normal and was passed voluntarily. It was decided to operate upon him, which was done 36 hours after the onset of the accident. The leucocyte count just before the operation was 18,000, showing a distinct polynucleosis.

*Operation.*—An incision eight inches long was carried through the right rectus over the region where the swelling had projected, down to the peritoneum. The peritoneum appeared dark, as it does in large intra-abdominal hemorrhages. Immediately on incising the peritoneum large quantities of blood-stained, jelly-like substance welled out. The entire abdominal cavity was filled with it, including the pelvis, and the whole intestinal canal was bathed in it as were the spleen and liver. This substance was the contents of a huge cyst that had ruptured. The line of rupture extended in a line parallel with the ascending colon one-half inch anterior to it and five inches in length. The cyst wall was variable in thickness, from one-quarter to three-quarters of an inch, and firmly united to the ascending colon along its outer border; it was also firmly and broadly attached to the lumbar region. The cyst cavity had been only partially emptied, and as the hand was introduced, aside from the dark-stained, jelly-like substance, a large quantity of white-streaked, half-congealed fluid welled up, which had the appearance of chalk mixture or white paint. From within the cyst cavity (which cyst emanated from the lumbar region) the right kidney could be palpated, and the hand then extended over the kidney to Poupart's ligament below. Upward within the cyst the hand met with a round constriction the size of a half dollar in circumference which admitted three fingers, and, in introducing the three fingers, entrance was gained into another cyst cavity filled with the same kind of substance. Through this last cyst the liver could be palpated. The longitudinal axis of the entire cyst cavity extended from Poupart's ligament to the liver, and the anteroposterior axis, from the anterior surface of the right kidney to a point projecting at least one inch beyond the abdominal wall over the right rectus one inch below the umbilicus (see Fig. 1). The cyst could not be enucleated, due to its tremendous base of attachment. The endeavor to bring its wall outside of the abdomen at the line of rupture so as to drain it wholly extraperitoneally was also futile, as the rent was deep, alongside of the lower portion of the ascending colon and firmly attached. A rubber dam was made and carried to the rent along the median side of the rupture, in the hope that it would direct the drainage extra-

peritoneally. The abdomen was thoroughly sponged out, and for this purpose large towels wrung out in hot salt solution were used, and just one dozen were stored away in the abdomen at one time, two in the cyst cavity. The substance of the cyst was of a peculiar consistency. It was jelly-like, would easily crumple between the fingers, and, though in places fairly firmly adherent to the abdominal viscera and parietes, it would not adhere to the sponge cloths. When the towels were removed by torsion, in that way the jelly lumps could be more readily dislodged and made to stick better, the abdomen was found surprisingly clean. It was effectively drained and closed by tension sutures. The upper and lower portions of the wound were tightly closed, and the middle portion was left open as an egress for drainage tubes. One of the original towels was left in the cyst cavity to expedite matters, as the patient was in a precarious condition. The cyst contents when examined showed the following:

*Gross Examination.*—Numerous large and small fragmented masses of a gelatin-like consistency and a coffee color, a slight amount of ropy pseudomucin which showed streaks of a chalk-like substance and considerable greyish-white opalescent substance.

*Microscopic Examination.*—Showed the gelatin-like substance to be composed of a colloid-like material very similar to the contents seen in a multilocular cystadenoma of the ovary. The opalescent substance was composed almost entirely of pure cholesterin crystals; the chalk material of calcium soaps. In the ropy pseudomucin were seen numerous large spindle-cells and an occasional polymorphous epithelial cell, numerous leucocytes and red blood-cells. There were no echinococcus hooklets.

The patient rallied slowly though effectively. The points of interest during convalescence are that on the twenty-third day after the operation a fecal fistula appeared, which at times discharged profusely. The cause of the fistula was in all probability due to the injury done to the gut, in the endeavor to separate the cyst sac, at the time of the operation. He was discharged November 21 (82 days after the operation), with a small fecal fistula. The blood examination on day of discharge showed hæmoglobin, 60 per cent.; erythrocytes, 4,200,000; leucocytes, 10,000; polymorphonuclears, 66 per cent.; lmphocytes, 32 per cent.; basophile, 1 per cent.; transitionals, 1 per cent. No abnormal red or white cells, mild secondary anæmia of the intermediate type. He rapidly gained in weight and soon exceeded his accustomed weight and resumed the activities of his business. From this time on he continued in his accustomed state of health, with only a slight inconvenience of a persistent small fistula, which, however, never healed entirely. In the following May (eight months after the operation) the fistula began to discharge more profusely and he

complained of considerable tenderness over the area of the incision, and at times would have a temperature of 101° F. The discharge was of the same character as originally described, all of which proving that the lining membrane of the cyst wall was functionating actively. At this time, too, the kidneys first began to show evidence of a nephritis, numerous hyaline and granular casts with faint traces of albumin being found. Although greatly inconvenienced by the discharge, it becoming necessary to change the dressing daily, he still remained active in business until October, when he had an attack of influenza. From this time on he began to fail rapidly, losing his appetite, weight and strength, developing a cachexia and gradually becoming weaker until his death, May 24, 1912 (twenty months after the operation).

*Autopsy and Pathology.*—A partial autopsy was allowed, and performed on May 25, 1912, after the body had been embalmed.

The following is abstracted from the protocol:

*Causa mortis:* Chronic diffuse nephritis, chronic toxæmia, following prolonged suppuration.

*External examination:* Male body about sixty-five years of age. Nutrition poor, considerable emaciation. Skin over entire body pale and wrinkled. All bony prominences markedly pronounced. Old healed laparotomy scar over right rectus, with small fistulous opening about its centre. No palpable lymph-glands. No abnormalities.

*Internal examination:* Abdomen: On opening the abdomen the peritoneal cavity contained about 300 c.c. of straw-colored fluid. The viscera occupy their normal position, with the exception of the ascending colon and cæcum, which have been pushed slightly over towards the median line by the tumor. The tumor occupies the whole right flank, is covered on its left side by peritoneum, and is composed of a large, partly collapsed cyst with thick walls. The cyst cavity contains soft, friable and cheesy tissue, springing from the inner surface of the cyst wall and lying free in the cavity. This cyst cavity communicates with the outside by means of the fistulous tract in the abdominal scar. There is no communication of the cyst cavity with the general peritoneal cavity. Posteriorly the cyst springs from the lumbar region, between the upper pole of right kidney below and the liver above. The right adrenal is normal.

Studded over the parietal and visceral peritoneum, but chiefly the latter and particularly over the mesentery of the small intestine, are numerous small, grey, slightly raised nodules 1–4 mm. in diameter.

Gross changes in the other viscera examined were: Chronic degenerative and productive nephritis; chronic interstitial splenitis; chronic parenchymatous degeneration of liver; and pulmonary œdema.

Sections made from the cyst wall show the histological picture of a colloid cyst adenoma, similar in every respect to the multilocular colloid cystadenoma of the ovary (see Fig. 2).

Sections made from the nodules found scattered over the perito-

FIG. 1a.—Showing position of tumor as found at operation.

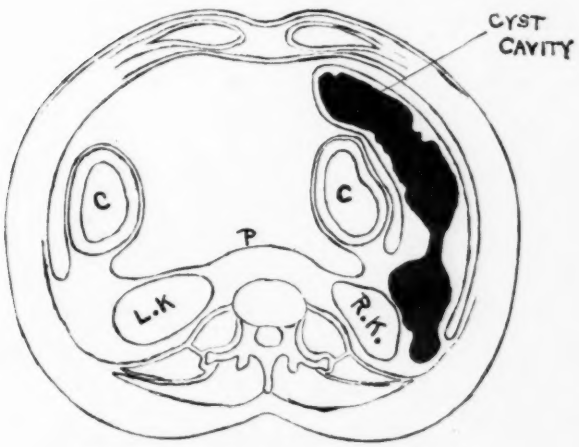



FIG. 1b.—Transverse diagram, showing tumor.

FIG. 2.—Section from wall of cyst, showing adenomatous character of lining membrane.

FIG. 3.—Section from peritoneum over mesentery of small intestine, showing adenocarcinoma.

neum show them to be transplants of the original tumor, transplanted when the cyst ruptured and discharged its contents into the peritoneal cavity, and producing the so-called peritoneal metastasis with ascites, as is commonly seen in papilliferous cystadenoma of the ovary (see Fig. 3).

EMBRYOLOGICAL EXPLANATION

*A. Development and Retrogression of Wolffian Body.*—The Wolffian body—mesonephros—undergoes segmentation by evagination of the mesothelium into cell cords, which in the pronephros remain solid cords, but in the mesonephros they develop into a series of transversely directed tubules which acquire a communication with the Wolffian or mesonephric duct. This duct, too, in the pronephros, known as the pronephric duct, is impervious. The Wolffian duct, known as the pronephric or mesonephric duct in its respective situation as it traverses through the pronephros or mesonephros, is formed by the invagination of mesothelial cells of the mesoderm to form a cord of cells. The pronephric portion posteriorly acquires some cells from the ectoderm also (an important fact, the deduction of which will be considered later). In the fully developed Wolfian body (seventh week of fetal life) it consists of the Wolffian duct, running parallel and lateral to the primitive vertebral column, emptying into the cloaca, and a series of transverse Wolffian tubules opening into the duct. As a further step in the development of an organ adapted to the function of the secretion of urine, each Wolffian tubule is invaginated by a capillary branch of an artery from the aorta forming a glomerulus, which with its enveloping capsule of Bowman constitutes a primitive malpighian corpuscle, a structure analogous to the malpighian corpuscle of the permanent kidney. These transverse tubules of the Wolffian body are divisible into an anterior, upper or cephalic series distinguished as the sexual segment and a lower, posterior or caudal set of atrophic tubules. In mammals the functional activity of the Wolffian body is but temporary and is supplemented before the end of fetal life by the permanent kidney. In man retrogression begins at the eighth week of fetal life and the malpighian body has disappeared by the fifth month of fetal life.

*B. Sex Gland Differentiation.*—The generative organs of both sexes, in the course of their development, pass through a stage in which there is to be found no distinction of sex. This stage is designated as the undifferentiated sexual apparatus. While the Wolffian body is attaining its full development, there appears in its vicinity a tube, the duct of Müller, parallel with and to the outer side of the Wolffian duct; its

exact origin has not yet been definitely made out; it is supposed to be produced by an invagination of the mesothelium of the body cavity in its upper portion, and the remaining lower segment results from a fission or a longitudinal division of the Wolffian duct. Its lower end opens into the cloaca, as does the Wolffian duct. While the duct of Müller is forming, the mesothelial cells overlying the surface of the Wolffian body toward the median plane undergo multiplication, forming an elongated swelling or ridge; this is known as the genital ridge (appears in the fifth week). Further differentiation of the genital ridge results in its transformation into the so-called undifferentiated sexual gland, a structure common to both sexes at this stage (see Fig. 4). The mesothelial cells become modified in character and are called germinal epithelium; as they extend into the interior of the ridge or gland they give rise to

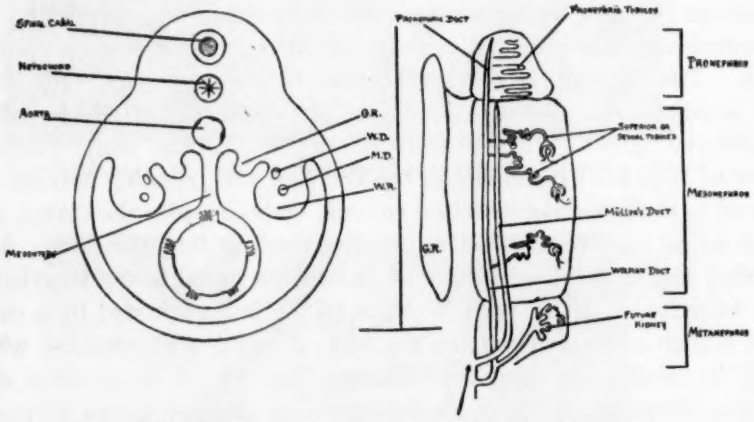



FIG. 4.—Diagram showing development of genital and Wolffian ridges.

the germ cells, the ova or spermatozoa as the case may be, known at this stage as the primitive seminal cells or primitive ova. The undifferentiated sexual gland comes into an especially close relation with the upper anterior cephalic or sexual series of the mesonephros or Wolffian body. The elements of the undifferentiated stage of the sexual apparatus are therefore the undifferentiated sexual gland, the Wolffian duct and the duct of Müller; from this sexual stage, either the male or female type is produced by the metamorphosis of the undifferentiated gland into the testicle or the ovary, and the formation of the ducts to provide for the escape of the sexual elements, spermatozoa or ova, produced by them. The differentiation of the undifferentiated sexual system into the male type is effected by the further development of some parts and the atrophy or the arrested growth of the others. The

testicle has a double origin—the secretory part is produced by the metanephros and the undifferentiated sexual gland, while the system of efferent or excretory part is furnished by the Wolffian body, that is, by the anterior, upper or sexual tubules of the Wolffian body. When the metamorphosis is complete we have the seminiferous tubules; during fetal life, however, and even to the period of puberty these tubules remain as solid cords of cells. At the same time, also, marked changes occur in the Wolffian body; from the sexual, anterior or upper series of transverse Wolffian tubules cords of cells grow forth and penetrate the genital gland, their ends fusing with the primitive seminiferous tubules; the conversion of these cell cords into tubules furnishes the initial part of the system of excretory ducts of the testicle—the vasa recta and rete testis. Later the rete testis is extended to form the vasa efferentia and still later the efferent vessels lengthen and become tortuous, producing thereby the coni vasculosi or head of the epididymis. The upper part of the Wolffian duct develops into a convoluted tube which constitutes the head and tail of the epididymis, while the lower portion becomes the vas deferens, thus completing the system of canals provided for the escape of spermatozoa. It will be seen that while the secretory part of the testicle results from the metamorphosis of the undifferentiated genital gland (the secretory cells having their origin in the germinal epithelium) the complicated excretory system of ducts with which it is provided is furnished by the Wolffian body. The series of tubules connected with the upper extremity of the Wolffian duct, the remnant of the pronephros, frequently persists as a little pedunculated sac attached to the upper part of the epididymis and is known as the stalked hydatid or hydatid of Morgagni. The posterior, lower or atrophic set of Wolffian tubules likewise give rise to an atrophic structure, the paradidymis or organ of Giraldès, constituting a series of short tubes closed at both ends, lying among the convolutions of the tail of the adult epididymis. The duct of Müller remains atrophic in the male through its entire extent, and with the exception of its two extremities it usually altogether disappears. Its upper extremity persists as a small vesicle, unstalked or sessile hydatid, attached to the upper aspect of the testicle. The lower extremity of the duct, uniting with its fellow, becomes converted into the uterus masculinus of the prostate gland. The change of location which the testicle undergoes is a conspicuous feature of its development. It becomes gradually displaced from its position at the side of the lumbar spine and by the third month reaches the false pelvis; by the fifth to the sixth month it is in contact with the anterior abdominal wall near the internal ring; by the

eighth month it enters the inguinal canal, and near the ninth month enters the scrotum (see Fig. 5).

In the female the undifferentiated sexual gland becomes metamorphosed into the ovaries and, while the Wolffian tubules and Wolffian body become in the male system the excretory ducts of the testicle, they produce in the female merely atrophic structures. On the other hand, the duct of Müller which gives rise in the male to atrophic appendages, forms in the female type the Fallopian tube, and by fusing with its fellow of the opposite side, the uterus and vagina. The ovary results from the alterations in the structure of the undifferentiated genital gland analogous to those that occur in the evolution of the testicle; as in the

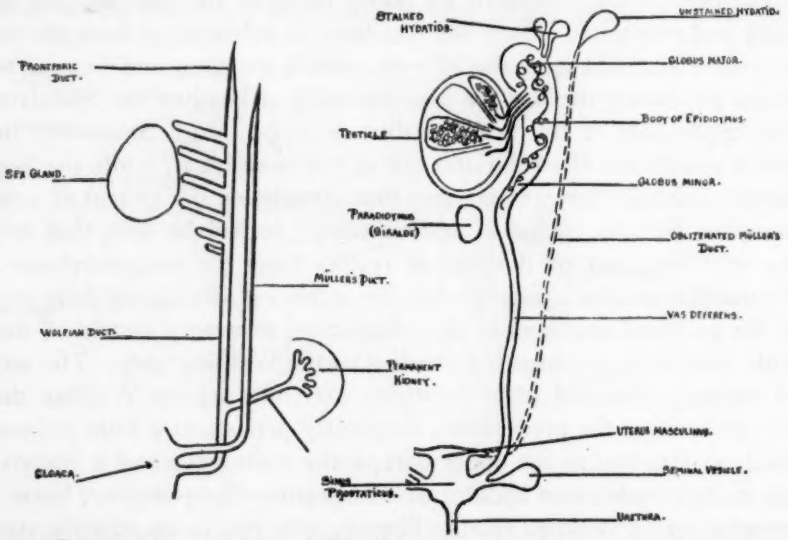



FIG. 5.—Diagram showing undifferentiated and male genito-urinary systems.

case of the development of the testicle, the mesothelial cells on the peritoneal surface of the genital ridge become thickened, constituting the germinal epithelium; these together with the indifferent mesodermic tissue form the sexual cords (primitive ova), forming into groups and constituting the Graafian follicles, the secretory system of the ovary; the excretory system results from the metamorphosis of the duct of Müller in its upper ununited portion into the Fallopian tube, in its lower fused portion into the uterus and vagina. The upper end of each single tube expands to form the fimbriated extremity of the Fallopian tube. The Wolffian duct, which in the male becomes metamorphosed into a part of the epididymis and the vas deferens, remains undeveloped in the female, producing merely atrophic or vestigial

structures. The upper series of the Wolffian tubules, the remnant of the pronephros, frequently persists, as in the male, in the form of a small pedunculated sac, the stalked hydatid or hydatid of Morgagni. When present it is found in the broad ligament in the neighborhood of the outer extremity of the ovary. The anterior or sexual series of the Wolffian tubules with adjacent part of the Wolffian duct, which in the male type develop into the epididymis, become, in the female, an atrophic structure known as the epoöphoron, parovarium or organ of Rosenmüller. This structure is almost constantly found between the layers of the broad ligament in close proximity with the ovary, and consists of a large horizontal tube, representing a segment of the Wolffian duct, and of shorter vertical tubes joining this at right angles, which represent the transverse Wolffian tubules. The lower set of Wolffian tubules,

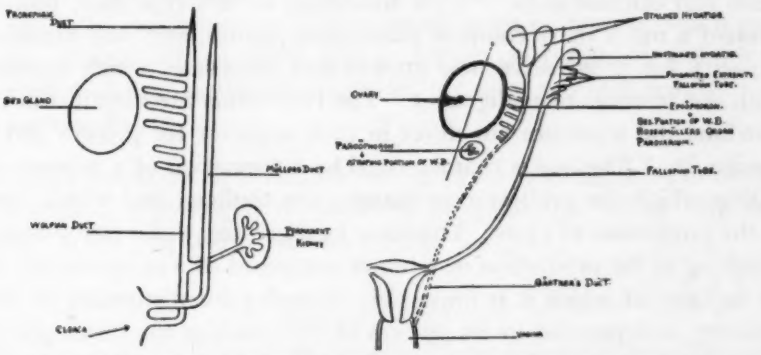



FIG. 6.—Diagram showing undifferentiated and female genito-urinary systems.

those which in the male become the paradidymis, give rise to a homologous atrophic body in the female, the paroöphoron. This is also situated in the broad ligament to the inner side of the ovary. The Wolffian duct, except that portion of it that develops in the formation of the parovarium, usually entirely disappears; occasionally it persists as a small canal traversing the broad ligament close to the uterus, to be lost in the upper part of the wall of the vagina, near the urinary meatus. When it persists it is known as the duct of Gaertner. The change of position of the ovary is similar to that of the testis, the difference being that the testis undergoes an external descensus, during which no alteration of the relative position of the parts occurs. The ovary rotates through 90 degrees and comes to lie with its axis horizontal (see Fig. 6).

*C. Origin of Cystadenomata.*—Cysts may arise from unabsorbed remnants of any of these embryonic structures. The situation of

the cyst depends upon the situation of the unabsorbed remnant of the embryonic structures, that is, the cyst may develop from vestiges of the Wolffian body in their original, abdominal, retroperitoneal situation, or from vestiges after they are carried down with the descent of the testicle or ovary in their course of migration.

The nature of these cysts depends upon the nature of the original cell layer from which they gain their origin, and as the vestiges are derived almost exclusively from the evaginative and invaginative processes of the mesothelial cells the cysts are adenomata (exclusive of simple retention cysts). In general the cysts consist of a simple large, thick-walled cyst, having attached to its interior a variable number of smaller and thinner-walled cysts, and contain a seromucous material occasionally discolored by extravasated blood pigment, besides cholesterin and calcium salts. "Cyst formation of this type may, however, present a much more complex anatomical picture, and may manifest a capacity for progressive new growth and extension, which endows it with the features of malignancy. The two forms are identical in their fundamental structure but differ in their capacity for growth and extension."[1] "The one is characterized by a formation of a primary cyst within which the proliferative changes are confined and which results in the production of cysts. The other by a greater proliferative capacity resulting in the production of a tumor composed of a congeries of cysts on any one of which it is impossible to confer the distinction of being primary, and peculiar by its powers of extension in the tissue plane in which it originates and the consequent involvement of distant parts."[1]

Clinically, we find these cystadenomata in the form of a typical uni- or multilocular cystadenoma of the female arising from vestiges of the parovarium, and the more complex and more malignant papilliferous cystadenoma arising from vestiges of the mesonephros in the hilum of the ovary, which with the migration of the ovary have been carried down from their primitive abdominal position. In the male, as in the female, very similar conditions exist. The vestiges of the mesonephros normally are displaced from their abdominal position with the descent of the testicle and in the adult are recognized in the organ of Giraldès (paradidymis), and in certain cell groups situated in the tissue of the hilum of the testis. From these tumors may originate which in structure are cystadenomata, either simple or papilliferous, and which are homologous with hilum cystadenomata of the ovary. Both in the male and female aberrant portions of the mesonephros may retain their primitive abdominal situation and give rise to retroperitoneal cystadenomata identical with these tumors of the ovary and testicle.

Thus far all cyst formations considered have been true cystadenomata of mesothelial origin; should, however, the posterior layer of the impervious pronephric portion of the Wolffian duct be involved in the formation of the cyst, and since it is derived not only from mesoderm but ectoderm, it is my opinion that we may get a dermoid cyst either in male or female intra-abdominal, testicular or ovarian in situation. Some authorities have spoken of this entire class of cysts as dermoids; this is impossible, since the condition *sine qua non* of dermoids is the involvement of true skin as their lining.[1]

## CONCLUSIONS

We have then a class of cysts which invade the peritoneal cavity in their course of development, which contain colloid material, cholesterin, calcium salts, etc., which may occur in the male or female, which may be uni- or multilocular, which may be benign or malignant, and which are always of retroperitoneal origin, arising from vestigial remnants of the mesonephros.

I wish in conclusion to make my grateful acknowledgments to Dr. H. S. Martland, Pathologist of the City Hospital, for active help and counsel in the preparation of this article.

## REFERENCES

[1] Moore, F. Craven: Peritoneal Multilocular Cystadenomata of Retro-peritoneal Origin, Med. Chron., Manchester, February, 1903.
[2] Brown and Brady: New York Med. Jour., January 4, 1902.
[3] MacDonald: Edinburgh Med. Jour., 1885, xxx, 1074.
[4] Dowd, C.: Ann Surg., October, 1909, xxxii, 515.

In addition to the articles previously cited, the following references have been consulted:

Nothnagel: Encyl. Pract. Med.
Adami, G.: Princ. Path.
Heissler: Text Bk. Embry.
Minot: Embryology.
Kaufman, E.: Spez. Path. Anat.
Orth, J.: Lehrb. Spez. Path. Anat.
Borst, M.: Lehre v. d. Geschwülsten.
Sobotta and McMurrich: Atl. and Textb. Hum. Anat.
Keibel, F., and Mall, F. P.: Man. Embry. J. B. Lippincott Company, 1912.

# THE SURGICAL SIGNIFICANCE OF INTESTINAL ANGIO-NEUROTIC ŒDEMA

WITH AN ILLUSTRATIVE CASE

By Arthur H. Bogart, M.D.

of Brooklyn, New York

SURGEON TO THE METHODIST EPISCOPAL AND CONEY ISLAND HOSPITALS ASSISTANT SURGEON TO THE KINGS COUNTY HOSPITAL

Within the past eight or ten years a number of cases have come under our observation of what seemed to be acute intestinal obstruction. They have usually occurred in males between the ages of thirty and forty-five years.

The history in each of these cases has been somewhat as follows:

A sudden onset, with abdominal pain, nausea, vomiting and distention, with inability to move the bowels. These cases, as a rule, have been treated by the family physician as cases of acute indigestion due to errors in diet, but, failing to respond to the usual treatment, we have had an opportunity of seeing them with a view to surgical interference.

When seen by the writer, usually about 48 hours after the beginning of the symptoms, the chief complaint has been intermittent, cramp-like pains in the abdomen, nausea, vomiting of a dark bilious material, with occasionally a decided fecal odor, abdominal distention, great prostration and an inability to have a satisfactory movement of the bowels. The pulse is usually rapid and feeble and the temperature slightly, if at all, elevated.

The picture as presented by these cases has been that of a very serious illness, probably intestinal obstruction, requiring operative relief, and yet a number of them have recovered without operation, usually by the use of repeated enemata and lavage.

Heretofore, we have been unable to satisfactorily explain to ourselves the cause of such an alarming array of symptoms and the complete recovery of patients from what seemed to be a desperate illness when recovery without operation seemed impossible.

It has occurred to us that the following case is worthy of report, in that it suggests at least the rôle which angioneurotic œdema may play in the production of such a group of symptoms:

A. D., aged forty-two years, steward by occupation; referred by Dr. J. Dusseldorf.

The present illness began suddenly two weeks before admission to

the hospital. While working, the patient became nauseated and several times vomited a greenish fluid, but had no particular pain at this time. For the next few days he was sick in bed, unable to work, and suffered from nausea and vomiting and inability to get the bowels to move satisfactorily. At the same time he suffered from abdominal distention and a feeling of fulness in the epigastrium. Repeated doses of medicine failed to move the bowels, nor was the patient able to pass gas as usual. At the end of ten or eleven days he improved and returned to his work, but was taken worse and had to return home. That evening he began to suffer from severe abdominal pain located in the upper abdomen and colicky in character. The nausea and vomiting returned and became very distressing. The vomitus was at first bilious in character, but later had a decided fecal odor, as suggested by the wife of the patient and confirmed by myself and the attending physician. The pain became so severe as to require repeated doses of morphia during the night.

The writer saw the patient early on the following morning, and found a well-nourished man with a rapid, thready pulse and a cyanotic condition of the skin. He was vomiting frequently the same material as described above. The abdomen was markedly distended, particularly in the epigastric region, and he was suffering from intermittent cramp-like pains, chiefly in the upper abdomen. There was some tenderness in the same region. The temperature was normal. There had been no passage either of gas or fecal matter from the bowels for 48 hours, although every effort had been made to secure one. The patient also complained of a stiffness and pain in the muscles of the back and arms and, when attempts were made to move him from side to side, there was apparent a general rigidity of the body, such as is seen in tetanus cases. When not vomiting, the man was continually spitting up material and belching gas.

We considered the case one of intestinal obstruction high up, but on account of the very desperate condition of the patient and previous experiences in similar cases, thought better to secure the services of a trained nurse and advised stomach washing every four hours and high enemata, in the hope that he might improve. This treatment was instituted and carried out during the night, with the result that on the following morning the patient's condition was very much better. The pain had been relieved, vomiting had ceased, the bowels had moved fairly satisfactorily in response to the enema, the pulse had come down from 140 to 90 and was of good character. In fact, the patient's condition was so good that we gave a favorable prognosis at this time. He remained fairly comfortable during that day, but the symptoms returned during the night and, when seen the following morning, operation seemed imperative, was advised and accepted.

*Operation.*—The stomach having been washed out, the patient was etherized and a right rectus incision made about four inches long. Upon opening the abdomen it was found to contain a considerable quantity of blood-stained fluid, such as is commonly found in cases of ileus. Inspection of the appendix showed it to be normal, but it was removed. The lower ileum was somewhat distended and congested, with a few ecchy-

motic spots. The intestine was now followed upward from the ileocæcal valve (the distended portion was not more than a few feet in length), after which the intestine was apparently normal in appearance *until we came to the jejunum, which was found to be in a very much swollen and œdematous condition. This swelling and œdema extended up to the point where the intestine passes beneath the mesentery, and was so pronounced as to produce a stiffening of the intestine sufficient to prevent peristalsis. When grasped between the forefinger and thumb, the intestine was apparently at least one inch in thickness. Evidently, the lumen of the bowel was almost, if not completely, obliterated by this swelling and œdema.* No further evidence of obstruction having been found, the wound was closed.

The patient bore this operation well, but the after-course of the case was such as to make us feel that but little benefit, if any, had been derived from it. The distention, particularly of the stomach, was marked, and had to be relieved by frequent washings, the benefit of which was very prompt, as shown by the improvement in the patient's general condition. The bowels did not move for several days and when they did begin to move the patient developed a diarrhœa with the passage of blood in small amounts. He gradually improved, however, and was discharged at the end of seventeen days after the onset of his symptoms.

NOTE.—Ten days after leaving the hospital, this patient developed œdema of both feet, one hand, and the left side of the chest. It cleared up rapidly in the feet and hand, but is still present in the chest wall, twenty-seven days after the onset of his symptoms. This tends to corroborate the diagnosis before made in the case.

Osler, in his *Modern Medicine*, vol. v, in speaking of the gastro-intestinal tract in angioneurotic œdema, says:

"This is involved in 34 per cent. of cases (Collins); ten of my patients had attacks of colic. We know now the nature of the local trouble, as exploratory operations have confirmed the view that it was an œdema of the wall of the bowel, and in a case reported by Morris, in washing out the stomach to relieve the severe vomiting, a portion of the mucosa was removed and on examination was found to be in a state of acute œdema.

"Colic is a common abdominal symptom, coming on suddenly and often reaching an extreme grade. As a rule, it occurs with the skin manifestations, but it may be the only feature, and there may be no clue to the nature of the trouble. In the majority of cases it is a 'dry colic,' the pain central, more or less continuous, wth paroxysms of greater intensity. The patient may roll about in the bed or be doubled up in an agony of pain. The abdominal walls are tense, there is not often tympanites and there may be no local tenderness. Appendicitis, gall-stone colic or renal colic is suspected, and in a considerable number of cases laparotomy has been performed. In severe attacks with the colic there is vomiting coming on with the pain and lasting for many hours. The patient may look very ill, with pallor, small pulse and features of collapse; and at the end of ten or twelve hours the symptoms may all disappear and an outbreak of local œdema gives the diagnosis.

"With the gastric symptoms and colic there may be intestinal symptoms,

diarrhœa, meteorism and even the passage of blood." He further states that "the abdomen may be swollen and tender, and the picture, sudden onset, vomiting, pain, diarrhœa, pallor, with feeble pulse, may suggest perforation of a gastric or duodenal ulcer. The passage of blood in children may suggest intussusception."

He fails, however, to mention intestinal obstruction as a possible error in diagnosis, which to us seems to be a very important point and one to be considered, for there is no doubt in the mind of the writer that the condition as described was the sole cause of the symptoms in the case reported, which were those of an acute intestinal obstruction.

If we are correct in our conclusions, it is evident that operation is contra-indicated; rest in bed, stomach washing, enemata and supportive treatment are suggested.

# SECONDARY ULCERS OF THE STOMACH AND JEJUNUM. FORMATION OF CALCULI AROUND UNABSORBABLE MATERIAL USED IN SUTURING THE INTESTINAL MUCOSA *

By A. L. Soresi, M.D.

of New York

## I. SECONDARY ULCERS OF THE STOMACH AND JEJUNUM

The existence of ulcers (especially peptic) around the new opening made by gastro-enterostomy has been reported in a sufficient number to make it a subject of interest to the surgeon. The following case led the author to study what effect silk and linen thread might have on the complete cicatrization of the operated mucosa of the stomach and of the intestines, and, therefore, on the production of secondary ulcers:

Mrs. M. A., aged twenty-nine, was operated on by the author for an ulcer of the duodenum by posterior gastro-enterostomy. The condition of the patient did not permit at the time of the operation to remedy other pathological conditions of the adnexa. The gastro-enterostomy was performed, using silk for both the through-and-through and the seroserous sutures. The patient made an uneventful recovery, gained in weight and was well. After about four months from the operation she had gained seven pounds, but was complaining that she had pains in the middle of the stomach if she was not exceedingly careful about her diet, and the pain was not getting any better; she had the impression of the pain being caused by swelling of the stomach. One hundred and forty-eight days after the gastro-enterostomy, the author made a second laparotomy in order to remedy the condition of the adnexa. The site of the former operation was carefully examined and was absolutely in a perfect condition, no adhesion and no kinking being present. As it had been promised to the patient that the cause of the pain would be investigated, a small incision in the anterior surface of the stomach was made, with the idea of using it as a possible opening for an anterior gastro-enterostomy, if it was necessary to perform it. The gastro-anastomotic opening was very plainly visible, had not contracted, and it showed that the silk was still in place and that there was a small ulceration of the mucosa of the stomach and another on the mucosa of the jejunum. The silk was removed, the stomach closed, and the patient made an uneventful recovery, and has not complained since of any pain, twenty months after the second operation.

* From Dr. Sorin's Surgical Institute.

Posterior gastro-enterostomy was performed 47 times on dogs, by the author and students taking courses, using silk or linen thread for the through-and-through and the seroserous sutures. At the autopsies, which were performed from one to ten months after the operation, the silk or linen thread was present, hanging in the inside of the stomach, in all but one case. There has never been any mortality due to the operation and all the animals were in good condition when sacrificed. Briefly the operations where the above-mentioned complications were present are as follows:

Dog No. 1, female, operated on eight months before autopsy. Ulceration of gastric mucosa and presence of hair twisted with the thread, as shown in Fig. 1; silk was used and pylorus excluded. Dog No. 2, female, operated on four months before autopsy. Ulcerations of the mucosa of stomach and jejunum (Fig. 2); linen was used. Dog. No. 3, male, operated on four months before autopsy; ulceration of the mucosa of the jejunum (Fig. 3); linen was used.

From the above experiences it would be reasonable to draw the following conclusions:

Unabsorbable material, silk or linen, is not eliminated after a period of ten months in animals, the peristalsis of which is very strong and which eat very rough food, such as bones and large pieces of meat.

The presence of the silk or linen thread is liable to cause ulceration of the mucosa of the stomach and the jejunum; this has occurred in three cases out of 47 or approximately 6 per cent. None of the animals seems to have suffered from the presence of the ulcerations.

Exclusion of the pylorus did not seem to have any effect, as only one animal out of seven in which the pylorus was excluded showed the presence of ulceration.

Silk and linen thread behaved about in the same manner; out of 47 cases silk was used in 26 and linen in 21, and ulcers were present in two cases where silk and one case where linen was used; this would seem to give a little preference to linen, but to the author it seems that a larger series would show about the same results in the use of either.

Of clinical value to the practical surgeon and in reference to human beings the following conclusions seem to be reasonable:

Unabsorbable thread, silk or linen, will practically in every case be present in the gastro-anastomotic opening for a long time.

There is no technic by which the thread might be made to be eliminated with what would be called mathematical certainty, because in the through-and-through suture the thread that engages the tissues,

which will later slough off, should be eliminated with the tissues that are sloughing away and are therefore eliminated. It is easily understood, that no matter how skilful and careful the surgeon is, it is impossible to keep the suture on a mathematical straight line; some stitches will go through the tissues a little more deeply than others, with the results that when sloughing of the tissues engaged in the suture begins, the suture becomes loose and the tissues engaged by the more superficial stitches will be eliminated first; regeneration of tissues begins by elimination of the dead tissues and where the stitches have occasionally been deeper, regeneration will take place around the thread, because the thread by not being taut does not cause any further sloughing. The thread will remain indefinitely in place, hanging from one or more points in the stomach or intestinal cavity.

It is evident that the presence of foreign material in the mucosa of the stomach and intestines will keep up a sort of irritation to the tissues and at the point of emergency of the thread will facilitate the infection of the mucosa and its dissolution by the acids of the stomach. That many patients who still complain of symptoms after a perfectly executed gastro-enterostomy are suffering from small ulcerations of the mucosa around the anastomotic opening is very probable, and that later some of them get better might be due to the fact that finally the unabsorbable material is eliminated and the mucosa has a chance to heal perfectly, as when the surgeon has occasion, as the author had, to remove the threads directly. It is also reasonable to think that patients with a very high acidity are more liable to suffer from the presence of the suture material in the stomach. That no more patients suffer from the presence of the suture material in the stomach might be explained by the fact that generally patients who have had to undergo a gastro-enterostomy are careful about their diet and follow some kind of medical treatment for some time, which would relieve symptoms.

As no trouble was apparently caused in the animals by the presence of the thread or even of the ulcers around the gastro-anastomotic opening, the percentage of which is low, it might seem useless to lay so much stress on the danger of using unabsorbable material for the through-and-through suture. We must take into consideration that the experiments were made on perfectly healthy dogs, which did not very likely have any tendency toward ever having any trouble with their stómach and intestines, and if we refer what has occurred in these healthy dogs to people who have to be operated upon on account of ulcers of the stomach and duodenum, we will easily understand that the facts are really important.

It is well to say that although a great number of surgeons have had splendid results from the use of linen and silk the facts mentioned above cannot be denied, and of importance to the surgeon is the question of " What is best to use? " With the perfection of technic the mortality from gastro-enterostomy should be *nil,* and in the hands of the competent surgeon it is practically so; our aim therefore is to avoid any unnecessary complication, no matter how trivial it might be; the formation of ulcers favored by the long-time presence of unabsorbable material in the mucosa is a really serious complication at times and really annoying always, even if it should not last long; therefore, we have to use a material that can be absorbed in a reasonable time, so giving the best of facilities to the mucosa to heal perfectly.

The author thinks that silk or linen should be used for the seroserous suture, because the serosa tolerates perfectly well the presence of unabsorbable material, and its presence might even help in the formation of strong adhesions; *that catgut, chromic or iodized, or even plain, should always be used for the through-and-through suture.*

It is well to state in a few words what happens in suturing the three coats of the stomach and the intestines, as it is done in the through-and-through suture in performing anastomosis and in repair work. The thread approximates tightly the three coats so that the blood-vessels are firmly secured and bleeding prevented. If this is done properly, it means that the blood supply of the tissues immediately interested in the suture is completely cut off; therefore they will slough and fall. The mucosa interested in the suture will also fall off, leaving a space not protected by mucous membrane. Leakage would occur very often, if suturing of the gastro-intestinal tract were done only with the row of suture known as the through-and-through suture, because sloughing might occur before firm adhesions have taken place between the serous coats; for this reason a seroserous suture is put in around the through-and-through. Adhesion between the sutured serous coats forms very rapidly and is evident a few hours after operation; adhesions between mucous coats are very slow, a perfect complete repair of the mucosa might take over a month. So long as the through-and-through suture is made only to prevent bleeding and approximate the cut edges, we have to see whether an absorbable material will do this or not. The process of sloughing of the mucosa begins 24 hours after operation and is generally completed from 5 to 20 days after.

It is evident that when the process of sloughing is fairly advanced, that is, from the third day to the fifth day after operation, the hæmostatic power of the suture must be *nil*; in any event if the suture has

not caused the production of thrombi in the blood-vessels strong enough to insure hæmostasis, bleeding would occur no matter what suturing material has been used. Therefore, if we use a suture material that can last over three days, we can be sure that we have done everything in our power to insure the best hæmostasis. Chromic or iodized catgut No. 1 will last much longer than three days, even in the stomachs of dogs, *and therefore chromic, iodized, or even plain catgut should always be used in through-and-through sutures in the gastro-intestinal tract.*

It seems reasonable to think on the strength of this argument that the cases reported in which leakage or hemorrhage was attributed to the rapid absorption of the catgut used for the through-and-through suture have been due to other causes.

In contrast with the reported case and experiments, the author has been using catgut for the through-and-through suture in over one hundred cases in human beings and in animals, with the most gratifying results in the former, and always finding at the autopsies of the latter a perfectly healed mucosa. Catgut has also been used in many animals for the seroserous suture without any ill results, adhesions of the serosa being absolutely perfect. The author is studying the mechanism of repair of the stomach and intestines, which will be reported when completed; for the present he would like to draw the following conclusions:

Catgut No. 1, either chromic, iodized, or even plain, should always be used for the through-and-through suture; as experiments and clinical experience have shown that silk or linen is almost always hanging in the stomach and intestines an exceedingly long time after operation.

The presence of the thread in the stomach might help the formation of new ulcers.

Silk or linen is to be used only for the seroserous suture.

## II. FORMATION OF CALCULI AROUND UNABSORBABLE MATERIAL USED IN SUTURING THE INTESTINAL MUCOSA

While studying the effects of unabsorbable material in suturing the mucosa of the stomach and jejunum in gastro-enterostomy, some experiments were also made on the effects of the same unabsorbable material in the through-and-through suture of intestinal anastomosis. While there has never been any ulceration of the intestinal mucosa around the points of emergence of the thread, and the mucosa had healed perfectly, other interesting phenomena took place.

FIG. 1.

Hairs twisted around thread

FIG. 2.

Ulceration of stomach and jejunum

FIG. 3.

Ulceration of jejunum

FIG. 4.

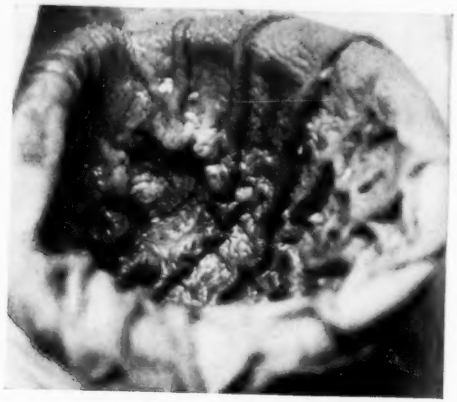


FIG. 5.

FIG. 6.

FIGS. 1, 2, 3, 4, 5, and 6, which are photographs of specimens, show the presence of the thread hanging loose in the new stoma made by the gastro-enterostomy.

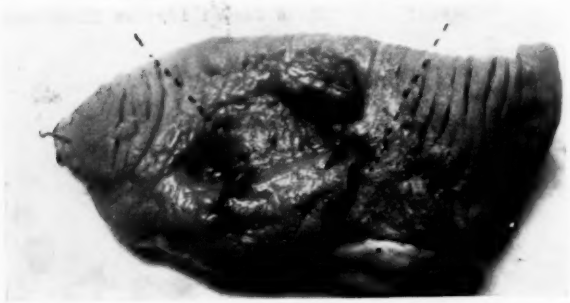
FIG. 7.

Large calculus formed around silk thread

Silk thread

FIG. 8.

Two small calculi formed around silk thread



Unabsorbable material, linen and silk, was used in 14 cases of side-to-side intestinal anastomosis. After periods of three to ten months the dogs were sacrificed; the thread had been eliminated in two cases and in three of the remaining twelve the thread had been the nucleus for the formation of calculi (Figs. 7 and 8). In the specimen in Fig. 7 the size of the calculus was about more than half the lumen of the intestine; the dog had been operated on nine months before the autopsy and was apparently in good health.

To the author it seems to be of clinical importance the fact that in patients, who suffer after operations requiring intestinal anastomosis, in which unabsorbable material had been used, the later symptoms might be due to the formation of calculi the nucleus of which has been the thread hanging loose in the intestinal cavity. That some of these patients get well after a certain period might be explained by the fact that strong peristaltic movements might later eliminate the calculi with the thread.

The same conclusions reached in the study of gastrojejunal anastomoses seem to the author to be applicable to the intestinal anastomosis, that is, that only catgut should always be used for the through-and-through suture and fine silk be reserved for the seroserous suture.

# CLINICAL ASPECTS OF COLON STASIS

By Joseph Rilus Eastman, M.D.
of Indianapolis, Indiana

The extraordinary impetus given to the study of intestinal stasis by the work of Sir Arbuthnot Lane has brought out on every hand reports of clinical, laboratory and röntgenologic observations with expressions of opinion of the most divergent character.

Mr. Lane alludes to the colon as the cesspool of our gastro-intestinal drainage scheme, to which Mr. Gray of Aberdeen rejoins that he regards it a slur on the Creator to speak of the cæcum as a cesspool, and Guillot of Havre says that to refer to the cæcum as a *fosse d'aisance* is nothing less than a gratuitous insult to an important part of the digestive tube. This ardent defence is of course wasted upon those who, like Metchnikoff and Barclay Smith, dispute any justification for the existence of the colon.

It will be recalled that Lane in his remarkable brochure, "The Consequences and Treatment of Alimentary Toxæmia," supported his views with the radical theses of Professors Metchnikoff, of Paris, and Barclay Smith, of Cambridge, the former stating, "It is no longer rash to say that not only the rudimentary appendix and the cæcum but the whole of the large intestine are superfluous and their removal would be attended with happy results," and the latter declaring that "the large intestine is practically a useless encumbrance."

The colon is, as is well known, often demonstrably the seat of stagnation of decomposing matter ridden with many and various bacteria, both dead and alive. However, it is important to note that such stagnation does not always cause alimentary toxæmia, the symptoms of toxæmia appearing, as emphasized by Case, when the vital defensive processes of the body are unable to destroy or eliminate by vicarious avenues the products of intestinal putrefaction.

There are, perhaps, few who in our present understanding will admit that the simple circumstance of the simultaneous presence of the *Staphylococcus citreus* in an infected joint and in the colon justifies removal of the latter organ for the cure of arthritis or that it is quite safe to leave a gall-bladder filled with stones as of little import while a complete colectomy is done for constipation, or that tuberculosis of the carpus is best treated by ablation of the large bowel, nor will they readily give up thyroidectomy or other surgery applied to the thyroid

gland in Graves's disease, and yet practically all surgeons acknowledge the greatness of the influence of Lane upon the study of colon stasis and subscribe in a general way to his views.

It matters little whether the process of extension of disease from the stagnant colon is that of auto-intoxication as described by Amussat, Humbert, and Bouchard, or whether it be that of subinfection as contended by Adami, one fact abides and that is that alimentary toxæmia is a reality and, moreover, its consequences as claimed by Lane are serious.

It is unfortunate that the distinction between constipation, intestinal stasis and alimentary toxæmia is not more clear. Constipation, according to Guillot, and many others, applies only to the sojourn of the fæces in the descending iliac and pelvic colons. Lane, with whom the term intestinal stasis originated, defines it as "Such abnormal delay in the passage of the intestinal contents through a portion or portions of the intestinal tract as results in the absorption into the circulation of a greater quantity of toxic or poisonous materials than can be treated effectually by the organs whose function it is to change them into products as innocuous as possible to the tissues of the body." Thus, from Lane's definition it appears that constipation may become colon stasis if auto-intoxication supervenes. This definition is obviously in no sense in conflict with the established belief that stagnation of intestinal contents may exist even for a long period without harmful alimentary toxæmia. It does seem somewhat arbitrary, however, to restrict the term stasis to conditions of stagnation with symptoms of toxæmia. Ought we not in the interest of clarity to make more frequent use of the expression, intestinal toxæmia, its meaning being manifest?

For practical purposes it is well to keep in mind a somewhat arbitrary division of intestinal stasis into two clinical varieties, the first amenable to medical or non-surgical treatment and the second amenable only to operation in some form. The first may be designated as functional, the second organic.

Mr. Lane, it seems, regards a rather large proportion of cases of intestinal stasis as surgical ones, and in operation if the colon comes up freely on a long mesentery and can be removed easily he takes it out; if not, an end-to-side ileosigmoidostomy is made. It is probable that most surgeons at present, however, prefer to reserve operation for those cases in which the colon is hampered or constricted by membranes and bands, extensively fettered by fixation adhesions or seriously deformed by gravitation or kinks. That is, it is preferred by them to operate only in cases of demonstrably organic stasis.

The relation of colitis to stasis and peri-intestinal adhesions and membranes is of noteworthy clinical interest. In cases of well-defined colon stasis, I have not failed to find an associated chronic colitis. Recently I had the privilege of a personal conversation with Prof. Arthur Keith of the Royal College of Surgeons upon this subject. Prof. Keith, who in the course of original work of great significance on the functions of the large bowel has examined microscopically a considerable number of colons removed by Sir Arbuthnot Lane for colon stasis, remarked that he found evidence of chronic colitis in two cases only. Many of those who have studied colon stasis from a clinical viewpoint will look upon the findings of Prof. Keith as surprising. Chronic colitis in some degree has been recognized in many cases of well-defined colon stasis with pericolonic adhesions and coloptosis. The chronic colitis was evidenced upon microscopic examination by the presence of plasmatocytes with eccentrically placed nuclei, overdistended goblet-cells, congested blood-vessels and round-cell infiltration.

It is possible that the reason for the comparative infrequency of colitis in the resected colons of Mr. Lane may be sought in the circumstance that Mr. Lane, giving a rather wide field of application to colectomy and ileosigmoidostomy, operates occasionally in stasis of a degree so mild that a less intrepid and less skilful surgeon might exclude it from the catalogue of surgical conditions.

In many cases of marked colon stasis the macroscopic appearance of the mucous membrane of the colon is apparently alone sufficient to justify a diagnosis of chronic colitis; that is, redness, induration, ulceration and the presence of excessive mucus could, it seems, hardly be misinterpreted.

Many writers upon this subject speak of the association of chronic colitis with stasis. E. Payr at the German Congress for Internal Medicine for 1910 described the manner in which coloptosis and stasis induce colitis, even to the stage of ulceration. He notes that as the result of long retention of colon contents decubitus ulcers appear.

An inflammation of the mucous membrane with profuse secretion is looked upon by K. von Noorden (*Zeitschrift für klin. Med.*, Bd. 76) and Payr as a quite natural result of hyperkinetic constipation. The hyper-physiologic contractions of the colon musculature lead to hypertrophy. The mucosa is infiltrated with round-cells and polyblasts, in addition the serosa is torn and irritated by high-grade localized distention leading to what Payr calls fixation adhesions. Occasionally the local ulcerative process leads to an active general colitis so that extensive areas of the colon mucous membrane are ulcerated. This process

Payr has demonstrated by röntgenograms. It need hardly be stated that the serosa will respond to the deep ulceration of the mucous membrane with an exudative inflammation leading to the formation of cicatricial strictures and of pericolonic membranes and bands.

I have produced in rabbits a colon stasis by prolonged intermittent ligation of the anus, and such an artificially induced colon stasis resulted in colitis and after a few weeks in the formation of plastic peritoneal adhesions which were drawn out into membrane form by the normal movements of the large intestine.

Virchow as early as 1853 observed that the accumulation of fæces in the cæcum and the ascending colon caused colitis and chronic peritonitis, which in turn produced a mechanical obstruction to the passage of fæces.

Stasis may lead to colitis. Colitis may become ulcerative and invoke a plastic peritonitis with extensive adhesion formation or "zygosis," as a similar process often observed in the fœtus has been designated by Prof. Keith. Plastic peritonitis with constricting bands and fixation adhesions arrests the procession of colon contents. Overloading causes ptosis, and ptosis, for example, implicating the colon transversum, brings about stasis.

Prof. Keith also remarked in personal conversation as noted above that he had been unable to discover by the examination of Mr. Lane's cases any direct evidence that pericolonic membranes had induced stasis. This observation by so eminent an authority is of much interest since it is apparently in conflict with the observations of many others. It is possible that Keith, examining Mr. Lane's specimens, found relatively few cases of extensive fixation adhesions in the sense of Payr. It is of course not meant to imply that Prof. Keith drew from the observations mentioned the general deduction that pericolonic membranes rarely produce stasis. Certainly permanent fettering and fixation of the colon cannot but lead to stagnation.

Mollisson and Cameron and Herz, having observed pericolonic adhesions and pericæcal membranes, frequently in adults and occasionally in young infants unassociated with constipation, conclude that such pericolonic bands can be neither the cause nor the effect of constipation. It is of course clear that adhesions or membranes which neither constrict the colon nor hamper its movements are harmless and of no importance; however, extensive fixation adhesions in the sense of Payr are surely fraught with harmful possibilities. It seems safe to assume for the purpose of clinical study that any one of the four elements, stasis,

colitis, adhesions or ptosis, may be caused by any or all of the other three. Temporary downward displacement of the transverse colon, as shown on a single skiagram, may of course be quite normal and bear no relation to stasis. Pendulum-like swinging of the mid-colon from its fixed extremities as well as cephalad and caudad movements may lead into error anyone who, depending on skiagrams, omits a prolonged screen examination (Case).

Rovsing (Thorkild Rovsing, *Gastrocoloptosis*) remarks concerning the intimate association of the factors of ptosis and stasis, that " in the moment when gastroptosis appears there comes on, *eo ipso,* a ptosis of the colon transversum, this segment of the colon sinking downward as far as the length of the mesocolon permits so that the transverse colon hangs like a garland between the fixed extremities, the curvatura hepatica on the one side and the curvatura lienalis on the other, gradually forming a more acute angle as the process of sinking continues. The result is that a condition of obstipation develops with a stagnation of heavy and hard fecal masses."

Von Noorden and Payr have made clear how such hard and heavy masses may produce ulcerative colitis and Virchow many years ago noted that colitis may invoke a localized or general peritonitis with plastic adhesions. Thus, we have the " circulus vitiosus."

It seems clear that intelligent treatment of any or all of these factors must be based on an understanding of this mutual relationship.

Treatment directed at the relief of chronic colitis will by virtue of the relationship shown above affect also the ptosis and stasis and likewise the associated plastic peritonitis.

Properly performed short-circuiting operations by the improved drainage which they provide or should provide doubtless relieve chronic colitis and indirectly affect favorably the other factors of stasis, ptosis, and peritonitis. It is well known that the fæces are to a considerable extent made up of epithelial debris, of intestinal secretions, and of dead and living bacteria and that these things mixed with food residue under the influence of contractions of the cæcum rise in the ascending colon. But this contraction is not constant. The empty cæcum is in repose; it does not contract. It is awakened to contraction only when the small intestine empties into it its liquid contents. It is this irritant which provokes the contractions (W. J. Mayo). If contractions are not produced in this way, the fæces composed of epithelial debris, mucus and bacteria have no tendency to be evacuated. The colon becomes atonic and incompetent and obstipation is increased by antiperistalsis. It is for this reason that ileosigmoidostomy may be said to be falsely conceived. By

this operation the liquid contents of the small intestine are not permitted to enter the cæcum to bring about contraction. It is perhaps for this reason that Lane, Leriche and others have been obliged to re-operate after ileosigmoidostomy and deal with an enormous fecal accumulation in the cæcum and ascending colon. Typhlosigmoidostomy or typhloproctostomy, however imperfect they may be, cannot fail for the reason noted above, for in these operations the fluid contents of the small intestine are permitted to enter the cæcum.

In cases of simple constipation concerning only the left colon, ileosigmoidostomy may be of lasting benefit, but it is debatable whether such a condition is not better treated by non-surgical means.

If the caput coli be anastomosed freely to the sigmoid or rectum at the lowest point possible without traction, then the reversed peristalsis of the ascending colon will favor drainage of the cæcum through the artificial opening in the floor of the pouch, which is the chief habitat of the ammoniacal food and intestinal bacteria of decomposition.

The improvement following short-circuiting operations is probably due in some measure to the relief of colitis with consequent relief of the associated factors mentioned previously. Direct drainage by allowing escape of bacteria-laden secretions leads to improvement in the colitis with consequent increase of propulsive power and proportionate decrease of stasis. This is a probability in stasis cases in which the colon is not completely fettered by firm adhesions. Unless the colon is thus hopelessly enveloped in dense membranes, the purpose of a well-planned short-circuiting operation aimed at complete exclusion of the colon should be, not by the complete exclusion to put the colon out of commission, but by relief of colitis, pericolitis and ptosis through drainage and rest to put the colon back in commission. If the stasis really concerns the cæcum and ascending colon, this cannot be accomplished by diverting the contents of the ileum into the rectum. The liquid contents of the ileum should still be emptied into the cæcum because of their ability to stimulate contraction.

Writing of ileotransversostomy, Oppel (ANNALS OF SURGERY, October, 1914) remarks that "after a complete unilateral exclusion, no matter whether such exclusion was effected by means of a communication between the ileum and the transverse colon, or by means of ileosigmoidostomy, the part of the colon thus excluded forms a cul-de-sac which accordingly varies in length. It also appears that this sac can by means of retrograde peristaltic movement fill up with fæces and thus cause serious trouble."

Grekoff (quoted by Oppel) has mentioned a case in which an ac-

cumulation of fæces in the cæcum after an exclusion led to a perforation, and caused the death of the patient.

DeQuervain, "in consequence of an accumulation of fæces, had twice to resect the cæcum and the ascending colon, following an anastomosis between the ileum and transverse colon, and Franké, formerly an ardent advocate of ileosigmoidostomy, has lately begun to talk about the dangers of antiperistaltic movements of the large intestine."

Quite recently Von Beck stated that "out of his thirty-two cases which underwent ileosigmoidostomy owing to chronic colitis, pericolitis, and also owing to an unsatisfactory position of the large intestine, six cases, in the course of time, developed intestinal stasis in the excluded cul-de-sac."

J. T. Case and Hamilton Drummond separately made röntgenograms of patients after ileocolostomy and found a definite dilatation of the terminal ileum. The loop of ileum between the anastomosis and the cæcum seemed to have taken over to some extent the function of the colon.

It need hardly be said that the operation of typhloproctostomy removes in an anatomic sense at least one cul-de-sac, the cæcum.

It has been noted repeatedly that when the cæcum is joined to the sigmoid much of the food passing from the ileum into the cæcum ascends the right colon. My first röntgenograms were made after such operations for stasis without extensive adhesions while the patient was still in the hospital. They revealed that the bismuth column did not pass from the cæcum through the anastomosis opening. Röntgenograms, made twelve hours after the bismuth meal was taken, showed the cæcum filled with bismuth, and subsequent examinations showed the bismuth column rising to the hepatic flexure. A week later, or three weeks after operation, röntgenograms showed that the bismuth column after reaching the cæcum passed partly through the anastomosis opening, though the greater part arose in the ascending colon as before. In cases with more extensive adhesion formation the proportion of colon contents passing through the stoma was greater.

It is Oppel's belief (*vide supra*) that if the cæcum be anastomosed to the sigmoid in a case of incompetent or obstructed colon transversum, the contents of the ileum after passing Bauhin's valve will not pass through the stoma in its entirety but part will go up the ascending colon till it meets the obstruction in the transverse colon, and that part

which escapes from the cæcum through the stoma into the sigmoid will not pass down into the rectum as desired but will be regurgitated upward in the colon descendens and not stop until it meets the obstruction in the transverse colon. In this manner, he says, two new cul-de-sacs for stagnant food are formed, one on each side of the obstruction. I think this is somewhat inconstant. Seven of my cases skiagramed after typhloproctostomy have not revealed this unfortunate condition.

Bergmann first anastomosed the cæcum to the sigmoid for volvulus of the ascending colon, and the operation in cases of stasis is hardly indicated unless membranes or adhesions so fetter the colon as to make such an exclusion necessary because of incompetency or obstruction. If the colon is obstructed at the hepatic or splenic angles alone, then colocolostomy, as practised by Payr, which excludes these flexures alone, is of obvious usefulness. Redundant sigmoid may be treated by the Troyanoff-Winiwarter anastomosis between the loops of the sigmoid or eventually the redundant colon may be resected. At any rate, after typhloproctostomy, coils of redundant sigmoid cannot with safety be left above the stoma. If axial torsion does not occur it is unlikely that a stoma between the caput coli and lower sigmoid or upper rectum will interfere with the discharge of the fæces *per vias naturales* unless the opening be so large and lax as to permit of vicious valve formation or there are coils of redundant sigmoid above the stoma, in which instances it is conceivable that a large proportion of the fæces might pass in the wrong direction through the stoma. It is not clear that Montprofit's operation of dividing the terminal ileum and anastomosing both end-to-side with the sigmoid represents an improvement over simple typhloproctostomy. Here an attempt is made to drain the excluded cæcum in defiance of the ileocæcal valve through the short stump of the ileum, whereas, this drainage of the cæcum can be accomplished more simply and more completely by a large stoma in the floor of the cæcum.

It is probable that time will demonstrate the fatuousness of either short-circuiting or resection operations in cases of stasis, not presenting demonstrable obstructing factors.

Notwithstanding the brilliant results attained by surgery since Mansell Moullin in 1900 made an ileosigmoidostomy for stasis, it is worthy of repetition that many cases of stasis, for example those having their origin in chronic colitis, can be relieved without operation, and unless peritonitis causing fixation adhesions is present with compressing membranes and bands, there is a likelihood of relieving ptosis and stasis by non-surgical means, such as prolonged use of petrolatum,

abandonment of girdles and corsets and correct standing and sitting posture with chest forward and abdominal muscles taut so that the abdominal viscera are held upon the shelf made by the declivity of the ileopsoas muscle and the fat of the loins, as remarked by F. H. Martin, Goldthwaite and Robert C. Coffey.

One of Sir Arbuthnot Lane's laconicisms relates to the abuse of physical exercise. "The professional athletes," he says, "are all toothless at forty." We do not take this to imply that proper exercise, for example horseback riding with attendant visceral succussion, is without value in stasis.

# THE RÖNTGENOLOGIC FINDINGS IN THREE CASES OF DIVERTICULITIS OF THE LARGE BOWEL

By R. D. Carman, M.D.
of Rochester, Minn.

(From the Mayo Clinic)

According to McGrath,[1] Graser in 1899 was the first to demonstrate the association of acquired diverticula with "isolated circumscribed adhesive peritonitis" on the colon, which had been mentioned by Virchow in 1853. Although not of common occurrence as compared with other lesions of the large bowel, diverticulitis nevertheless is met with sufficiently often to require its consideration in many cases with symptoms referable to the colon. Thus as early as 1907, Mayo, Wilson and Giffin [2] were able to report five cases operated on in the Mayo Clinic, and in 1912 Giffin [3] collected twenty-seven such cases, in seventeen of which there was involvement of the sigmoid. Giffin has discussed the symptomatology and only the salient features require mention here.

The proportion of males to females appears to be two or three to one. An inclination to obesity is noted almost without exception; the patients are of sound flesh with good color and, where loss of weight occurs, it is only slight. Abdominal pain, usually of considerable severity, is the rule. Often the patient is able to localize the pain to the sigmoid or descending colon. Constipation is complained of by the majority and is often of more than moderate severity. Vesical symptoms, such as frequency and tenesmus, are occasionally noted. In every instance of diverticulitis of the sigmoid, a mass was felt in the left lower quadrant or in the pelvis. The proctoscopic examination has been negative, save in one case, where the tumor had become partially intussuscepted into the rectum. Absence of blood from the stools is notable, and this is explained by the fact pointed out by Wilson,[2] that the inflammatory process is primarily extramucosal, and that the condition is really a peridiverticulitis.

Given a case with such symptoms, the differential diagnosis becomes a matter of some importance. One condition which must be eliminated is that of left-sided appendicitis. Here the röntgenologic examination would be decisive by showing the position of the cæcum. The most difficult differentiation is from carcinoma. While the symptoms are

not quite typical of carcinoma, they do not absolutely contradict it. Indeed, Wilson [4] has shown that carcinoma may develop within the diverticula. The question arises as to what can be expected from the X-ray.

McGrath,[1] in his very complete review of the pathology, has brought out the following facts: Nearly all these diverticula are of the " false " type, that is to say, they are hernia of the mucosa through the muscularis, commonly at points where the latter is penetrated by vessels. The chief causes are weakness of the muscularis with an increase of intra-intestinal pressure, such as occurs in stasis and gas formation. Diverticula vary in size from that of a pea to a hen's egg. They are usually round or ovoid, and most often sessile, though occasionally pedunculated. The opening into the bowel may be narrow and practically stenosed, or it may be almost as wide as the diverticular cavity. Except those in the small intestine, the sacs usually contain fecal matter and sometimes fecaliths. Histologically, the sac wall is made up of mucosa, submucosa and serosa, the muscularis being slight or wanting. The mucosa may be slightly atrophic or even ulcerated, but the most constant pathologic process is the chronic, proliferative, extramucosal inflammation, the " peridiverticulitis " of Wilson, with round-cell infiltration which results in mass formation.

Over a year ago I examined the fixed and somewhat shrunken pathologic specimens of diverticulitis at St. Mary's Hospital with regard to the possibilities of röntgenologic diagnosis of the condition. A cursory inspection of this material gave me the impression that the demonstration by the X-ray of the diverticula themselves was almost, if not quite, hopeless. The vast majority of them were far too small to be visualized even if their filling with opaque material could be assured. The few larger ones, if capable of being filled at all, were, I thought, likely to contain fecaliths or fecal material which would prevent the entrance of the opaque enema. The net conclusion was that a filling defect could in many instances be demonstrated, but that this could not be distinguished röntgenologically from a filling defect due to carcinoma. I still held this view when the three following cases came up for examination.

Case I (99,640).—Male, aged fifty-five, physician. Examined January 26, 1914. Family and personal history negative.

*Previous Diseases.*—Gall-stones (passed one); severe cholecystitis and peritonitis fifteen years ago.

*Former Operations.*—Twelve years ago he was operated on for left inguinal hernia and hemorrhoids.

*Clinical History.*—Post-operative abscess following above operation with symptoms of cystitis. The abscess developed around the ligature later, which was passed by urethra. Since then the patient has had symptoms of bowel obstruction, the last time in December, 1913, one attack five years prior to this. There were left-sided griping and gas pains with much distention. At one time the bowels did not move for eight days; ordinarily, however, they move regularly. Apparent lump and soreness in left iliac fossa with pressure affecting the bladder. Pencil stools before last attack. The patient returned to his home and, prior to his operation, March 17, 1914, suffered several obstructive attacks, with flatulence, rumbling and stinging pain over the pubis and left side during bowel movement. Sensation of "something pushing up from rectum" when in sitting posture. Some weight fluctuation but the greatest loss at any one time was twelve pounds. Urine negative. No record of examination of blood or fæces.

*Röntgen Examination* (Fig. 1).—January 27, 1914, patient was examined in the routine way by barium enema. Röntgenograms showed an irregular filling defect with marked narrowing in the sigmoid. Small barium shadows were observed outside the lumen of the bowel, an appearance quite unusual, and at that time inexplicable. From the clinical facts and the Röntgen appearance W. J. Mayo suggested to the patient that the condition might be diverticulitis.

*Operation.*—March 17, 1914, first stage of Mikulicz for tumor of sigmoid (diverticulitis, inflammatory). Bowel exceedingly thick and adherent to pelvic wall posteriorly; about fourteen inches of bowel involved. Subsequent stages performed on March 24, April 4 and April 24.

*Pathological Report.*—Tissue removed, sigmoid. Diagnosis: diverticulitis.

The patient made a good recovery, has taken on considerable weight and is carrying on his accustomed work.

Case II (105,595).—Male, aged fifty-one, merchant. Examined May 7, 1914. Family and personal history negative. Denies any previous disease.

*Former Operation.*—Appendectomy elsewhere, without any exploration.

*Clinical History.*—For ten years he has been constipated. In the past two years he has noticed a sore lump in the left lower abdomen which has been associated with an increase of constipation. On two occasions this lump became swollen and very tender. In December, 1913, he had a chill with fever, and griping pain with gas, marked swelling and soreness at the spot complained

of. Recent similar attack four days ago. Stools small and tapered, necessitating laxatives, but no blood or pus noted. When the lump is swollen, the patient has frequent urination with some pain. General health good. Weight loss five pounds.

*Physical Examination.*—Tenderness and resistance in lower left abdomen. Rounded elongated mass felt by bimanual examination. Rectum seems negative aside from small hemorrhoids.

*Proctoscopic Examination.*—Negative.

*Röntgen Findings* (Fig. 2).—Negative save for slight enlargement of cæcum. At the same time small shadows were noted outside the sigmoid lumen, but their significance was not at that time appreciated.

*Operation.*—May 13, 1914, first stage Mikulicz by C. H. Mayo. Diverticulitis of sigmoid. Subsequent stages May 19, June 2 and 23.

*Pathological Report.*—Tissue removed, sigmoid. Diagnosis: diverticulitis.

This patient made a complete recovery and has had no trouble since.

CASE III (114,002).—Male, aged fifty-four, merchant. Examined August 28, 1914. Family and personal history negative.

*Clinical History.*—Attacks of pain and tenderness in left iliac fossa. Illness began as a diarrhœa, lasting several months. He has recently noticed that a full bladder causes a sensation of pressure. During the past eight months he has had indefinite gastric symptoms with vague discomfort after meals. He is gradually losing weight and strength.

*Röntgen Findings.*—The röntgenogram (Fig. 3) shows a fairly normal colon save for insufficiency of the ileocæcal valve and some extralumenal shadows along the inner aspect of the descending colon. This patient has not yet been operated on.

In the first case, particular attention was given to the röntgenograms. These showed the filling defect of an organic lesion in the sigmoid and, although the history suggested a benign inflammatory lesion, carcinoma was nevertheless considered probable from the X-ray stand-point. The shadows noted outside the sigmoidal lumen could not then be accounted for. In the second case, these same shadows were seen but no filling defect was observed and no interpretation was attempted. When operation showed the existence of a diverticulitis in this case also, the plates of both cases were brought out and compared, and the presence of extralumenal shadows in both began to take on considerable significance. Still hampered by the preconceived idea that diverticula could seldom or not at all be visualized, I sought some other explanation of these

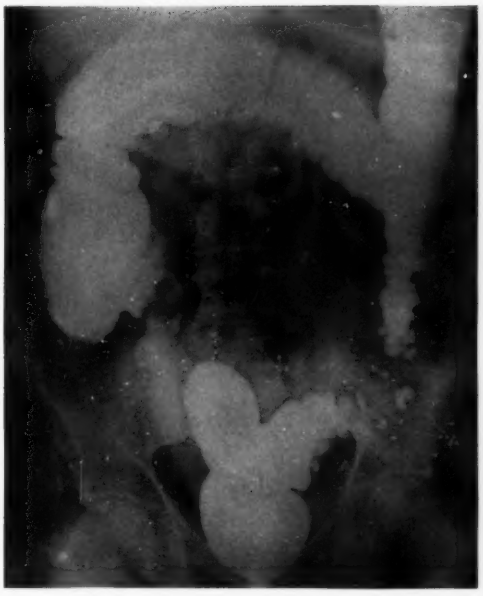


FIG. 1.—99640. Röntgenogram of barium-filled colon (enema), showing marked filling defect in sigmoid with extralumenal shadows (diverticula) at *A*.

FIG. 2.—105595. Shows barium-filled colon (by enema) with extralumenal shadow (diverticula) at *A*.

FIG. 3.—114002. Colon filled with bariumized enema. Diverticula at *A*.

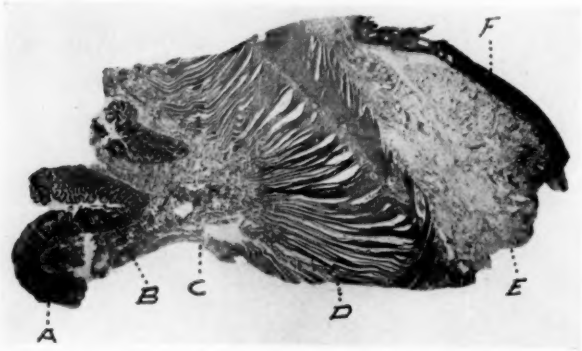



FIG. 4.—99640. Cross-section of wall of normal sigmoid, photomicrograph, magnified four times, showing normal mucosal fold. Note that this fold does not penetrate the musculature. *A*, mucosa; *B*, mucosal fold; *C*, submucosa; *D*, musculature; *E*, subperitoneal fat; *F*, peritoneum.

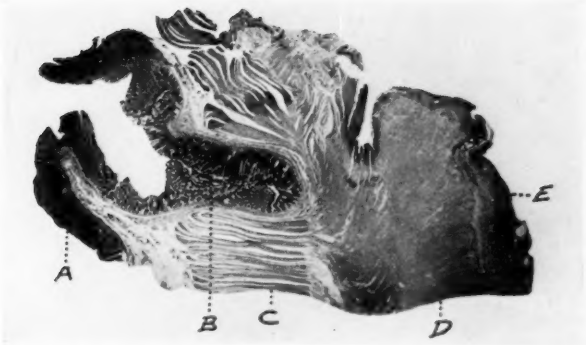



FIG. 5.—99640. Cross-section of wall of sigmoid, photomicrograph, magnified four times. Shows mucosal fold and submucosa separating the circular muscular fibres and penetrating to the longitudinal musculature. An early diverticulum of this type can hardly be demonstrated radiologically because of the absence of flask-like dilatation. *A*, mucosa; *B*, diverticulum; *C*, circular muscle fibres; *D*, subperitoneal fat; *E*, peritoneum.

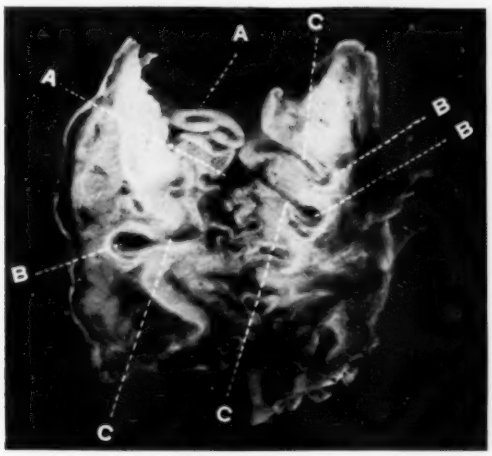



FIG. 6.—99640. Longitudinal section through sigmoid, showing multiple diverticula with marked thickening of intestinal wall and narrowing of lumen. *A*, mucosa; *B*, diverticula, containing fecaliths; *C*, canal leading to diverticular sac.

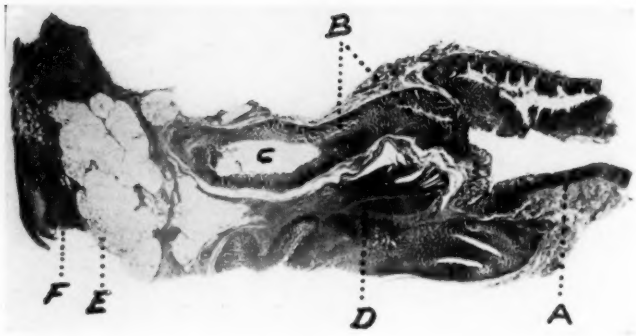



FIG. 7.—99640. Cross-section of wall of sigmoid, photomicrograph, magnified four times. Deep-seated, late-stage diverticulum with flask-like ampulla. The diverticulum has separated the circular fibres which are here seen compressing the neck, passed through the longitudinal bands of muscle and penetrated into the subperitoneal fat. This advanced type offers the greatest opportunity of radiologic demonstration because of its capacity and the distance from the intestinal lumen. *A*, mucosa of bowel; *B*, canal leading into diverticular cavity at *C*; *D*, musculature; *E*, subperitoneal fat; *F*, thickened peritoneum.

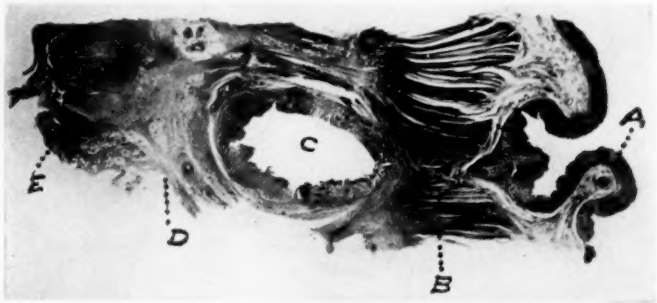



FIG. 8.—105595. Cross-section of diverticulum, photomicrograph, magnified four times. *A*, mucosa of sigmoid; *B*, neck of diverticulum (not well shown on account of depth at which section was cut), extending from lumen of sigmoid through circular muscular fibres to diverticular sac at *C*; *D*, subperitoneal tissue; *E*, peritoneum. Note that mucosal lining of the diverticulum is like that of the sigmoid, and it differs in this respect from the inflammatory pockets produced by perforating ulcer of the stomach which are often, but wrongly, spoken of as diverticula.

shadows. A colleague having suggested that they might be due to calcareous deposits, I secured the specimens, examined them, and present the results herewith.

Sections of the tissue removed from Cases I and II (Figs. 4–8) here illustrated show the customary pathologic changes. The diverticula of varying size have herniated through or partially through the muscularis and lie within the greatly thickened subperitoneal tissue. Some of them contain fecaliths, others are empty. No calcareous infiltrations are anywhere present. The extralumenal shadows in the röntgenograms, which are plainly shadows of barium, correspond in contour and situation to the larger diverticula.

Notwithstanding the fact that sigmoidal diverticula are commonly filled with fecal material, it is evident from the two cases herewith shown that the sacs are not always thus filled or may, at least in some instances, be emptied by purgation and a cleansing enema and, if of sufficient size, may be filled with an opaque clysma and be visualized by the Röntgen ray. When thus seen, they appear as oval or rounded barium shadows just outside the intestinal lumen, and this appearance would seem to have high diagnostic value in differentiating the condition from carcinoma. While a carcinoma might show more or less apparent pocketing due to degenerative changes, such pockets would not have the rounded symmetry of diverticula. In the case of carcinoma supervening upon diverculitis, which sometimes happens, if extralumenal shadows were present the röntgenologic appearances would be those of diverticulitis, while if these shadows were not present, the case would be regarded as one of carcinoma.

To be borne in mind is the possibility that by reason of a stenotic inlet, or extremely small size of the diverticula, or by their containing fecal matter, they may fail to fill with the clysma. In this event there would be seen only a filling defect proportional to the extent of the inflammatory thickening and not distinguishable röntgenologically from that of carcinoma. As to the chance of a fecalith being seen, that would depend upon its size, density and situation. It is also quite possible that sufficient barium may enter a diverticulum containing a fecalith to make the sac visible.

Phleboliths or calcified glands may give shadows resembling those of barium-filled diverticular pockets. If in the region of the upper sigmoid, palpation during the screen examination may show that the phlebolith or gland-shadow has no relation to the bowel, while that of a diverticulum moves with it. If situated near the lower sigmoid, which cannot be shifted about by palpation, the distinction could not be thus

made. Hence a screen or plate examination before administering the enema might be an advisable routine to eliminate the possibility of phleboliths or calcified glands in this region.

Since diverticula tend to occur near the mesenteric border of the bowel, in the neighborhood of the vessel entrances, they are usually best seen in the anteroposterior view. But they may occur in other situations and, if on the anterior or posterior wall, may be obliterated in the shadow of the bowel as seen in the anteroposterior view. For this reason, both the screen and plate examination should be made at various angles of observation, and stereoscopic röntgenograms made when possible.

The opaque ingested meal offers less chance than the enema of detecting diverticula, since the former scatters more or less irregularly through the bowel, the contour of the lumen is not well shown, and small detached masses of barium can hardly be differentiated from diverticula. The liquid enema, introduced under some pressure, is also more likely to fill diverticula than is the meal.

The rarity of röntgenologic findings in this condition can be understood from the fact that, so far as I can learn, only one case has hitherto been reported (Abbe [5]), the röntgenologic work being done by Le Wald. It is also worthy of note that a monograph published this year by G. Schwartz,[6] of Vienna, on the Röntgen diagnosis of the colon makes no mention of diverticulitis.

## REFERENCES

[1] McGrath, B. F.: Intestinal Diverticula: Their Etiology and Pathogenesis. Surg., Gynec. and Obst., 1912, xv, 429–444.

[2] Mayo, W. J., Wilson, L. B., and Giffin, H. Z.: Acquired Diverticulitis of the Large Intestine. Surg., Gynec. and Obst., 1907, v, 8–15.

[3] Giffin, H. Z.: The Diagnosis of Diverticulitis of the Large Bowel: a Clinical Review of Twenty-seven Cases. Jour. Amer. Med. Assn., 1912, lix, 864–866.

[4] Wilson, L. B.: Diverticula of the Lower Bowel: Their Development and Relationship to Carcinoma. Ann. Surg., 1911, liii, 223–231.

[5] Abbe, Robt.: A Case of Sigmoid Diverticulitis Simulating Malignancy: Demonstrated by Radiograph; Operation and Specimen. Med. Rec., 1914, lxxxvi, 190–191, 4 pl.

[6] Schwartz, Gottwald: Klinische Röntgendiagnostik des Dickdarm und ihre physiologische Grundlagen, Berlin, 1914, Verlag von Julius Springer.

# TRANSACTIONS
OF THE
# NEW YORK SURGICAL SOCIETY

*Stated Meeting, Held at the New York Academy of Medicine, November 25, 1914.*

The President, Dr. Frederic Kammerer, in the Chair.

## TRANSFUSION AND SPLENECTOMY FOR VON JAKSCH'S ANÆMIA IN AN INFANT

Dr. Eugene H. Pool presented a male infant who was admitted to the service of Dr. W. R. Williams at the New York Hospital on July 22, 1914. The child was then eight months old. It was a seven-months baby, born cyanotic and had been breast fed up to the age of four months. Since then he had ceased to gain in weight. The bowels were constipated. The child was restless and fretful and perspired a good deal, especially on the top of the head. He had had broncho-pneumonia twice; the first time at the age of four months; the second time two months later. The family history was negative.

When admitted to the hospital, the baby was very poorly developed and nourished, presenting evidences of anæmia and rhachitis. The edge of the liver could be felt 2 cm. below the costal margin in the right parasternal line, and the edge of the spleen was felt 5 cm. below the costal margin in the left mammary line. The Wassermann reaction was negative.

Repeated examinations of the blood gave the following results: The red blood cells ranged between 1,400,000 and 2,400,000; the white cells between 17,000 and 54,000; the hæmoglobin from 30 per cent. to 45 per cent. The differential count varied only slightly during the first month of the patient's stay in the hospital. A typical count was as follows: Polynuclears, 35 per cent.; eosinophiles, 2 per cent.; lymphocytes, 49 per cent.; transitionals, 3 per cent.; large mononuclears, 6 per cent.; myelocytes, 5 per cent. Nucleated red cells were constantly present, ranging from six to sixty-six per hundred white cells. Of these, there was an average of from two to three megaloblasts.

The diagnosis of von Jaksch's anæmia was ultimately made by Dr. Williams, who treated the child for six weeks, but his condition became progressively worse. He was very feeble, and it was decided

that splenectomy offered the only hope of improvement. Two days before operation the red cells numbered 1,660,000, the white cells 54,000, with 37 per cent. of hæmoglobin.

On August 17 Dr. Pool did a transfusion by the Lindemann method, 150 c.c. of blood from the father being introduced into the internal saphenous vein of the child. The latter was then etherized by the drop method and a three and a half inch incision was made through the left rectus and splenectomy performed. The wound was closed without drainage. The operative recovery was uneventful and the child's condition improved markedly for a time, but at present it was not as good as a month ago, although much better than before the operation.

The spleen was examined by Dr. W. J. Elser, who reported as follows:

> The specimen consists of a spleen measuring 10 x 7 x 4 cm., and weighing three and a half ounces. The organ is normal in shape and fairly firm in consistence, with a smooth surface, bluish-gray in color. The capsule is of normal thickness. The tissue, on section, is smooth and pale, grayish-red in color. The Malpighian bodies are few in number and extremely small and indistinct. The trabeculæ are not prominent. Microscopic examination shows the lesions attending the symptom-complex of so-called von Jaksch's anæmia. The most striking features of the sections are myeloidization of the pulp and atrophy of the Malpighian bodies.

The following report on the blood condition and its relation to the diagnosis of von Jaksch's anæmia was made for Dr. Pool by Dr. Ralph Stillman of the New York Hospital: " Following the operation, the red cells increased to 4,200,000, and the hæmoglobin to over 85 per cent. The number of white cells dropped gradually but steadily to 13,300. The differential count, however, showed essentially the same picture as before the operation. For example, here is a count made sixty days after the splenectomy: Polynuclear neutrophiles 16.0 per cent.; polynuclear eosinophiles 1.0 per cent.; polynuclear basophiles 0.25 per cent.; lymphocytes 52.0 per cent.; transitionals 4.0 per cent.; large mononuclears 1.0 per cent.; myelocytes 3.25 per cent.; degenerated cells 22.5 per cent.; normoblasts 14 per cent.; megaloblasts 4 per 100 white cells.

There was a decided increase in the reticulated cells as demonstrated by the " vital " stain. The color index has varied from 0.9 to 1.1.

Anæmia pseudoleukæmia infantum (Jaksch-Hayem) is a condition described as occurring in infants and characterized by marked anæmia, enlargement of the liver and spleen, and a characteristic blood picture. The spleen exhibits a myeloid metaplasia which may be very marked.

The blood shows a reduction both in the red cells and hæmoglobin, and the constant presence of nucleated red cells. The white cells are increased in number and may vary greatly, as in this case, where they jumped from 17,000 to 54,000 in two weeks, and then dropped to 19,000 during the next three days. The differential count is also subject to variations in the relative percentages of the polynuclears and the lymphocytes. Myelocytes are constantly present, though usually in small numbers. An especially important fact is that the blood picture remains essentially unchanged for months and years.

While this condition is usually described in the text-books along with pernicious anæmia or in close relation to it, it may better be classified as a variant of secondary anæmia. Its not infrequent association with rickets has led some to insist that the blood condition is merely one of the symptoms of the disease, but it has often been reported as occurring in the absence of any symptoms of rickets, and it seems much more rational to consider rickets as but one of the causes of the pseudo-leukæmic anæmia of infants. It is possible, of course, to get such a picture as is seen in this case in leukæmia, but aside from the fact that myelogenous leukæmia is an exceedingly rare and rapidly fatal disease at this age (eight months), such a blood picture would be only temporary and would soon change to that of the typical leukæmic blood count. This patient was in the hospital for about three months, during which time very frequent blood examinations were made, and at no time was the count typical or even suggestive of leukæmia.

## CARCINOMA ORIGINATING WITHIN AN ADENOFIBROMA OF THE BREAST

Dr. Pool presented a woman, forty-seven years old, who was admitted to the New York Hospital on July 8, 1914. One month before her admission she noticed a lump in her right breast. She was married, but had had no children nor miscarriages, and her menstrual history was regular. The patient was a well-developed and well-nourished woman.

In the upper right quadrant of the right breast there was a hard, slightly tender mass, about two and a half to three inches in diameter; it was sharply circumscribed, slightly nodular, and apparently was not adherent to the skin or deeper tissues. The nipple was not retracted and no nodes could be felt in the axilla.

Operation: The right breast was amputated, the skin, mammary tissue, fat and tumor being removed down to the pectoralis major. The tissue was examined immediately by a pathologist, who made frozen sections and reported that the tumor was an adenofibroma, and that there

was no evidence of malignancy. As a result of this report, the wound was closed without dissection of the axilla. Subsequent examination of the tumor, made by another pathologist, Dr. Elser, revealed the presence of carcinoma. This fact was explained to the patient, who consented to a second, radical operation, at which the skin, subcutaneous tissues and pectoral muscles were removed, and a clean dissection of the axilla was made. The patient's operative recovery was uneventful, and there was at the present time no evidence of a recurrence.

The following is the pathological report made by Dr. Elser:

The specimen received is a breast presenting in its substance a large, irregularly ovoidal, remarkably firm tumor, situated in part beneath the nipple. The growth, which was about the size of a goose egg, was sharply circumscribed and shells out readily excepting at one point, where it is firmly attached, and here the tumor seems to extend into the surrounding structures.

The macroscopic diagnosis in this case was a fibroma or a fibro-adenoma, and was based upon transections made from one-half the growth, the remainder being left intact for museum purposes. It may be mentioned that unfortunately the original transections did not include the area mentioned above, where the growth appeared to be invading the surrounding tissue.

Microscopic examination: A frozen section measuring 1 x 2 cm. made from a portion of the periphery of the growth showed the typical appearance of a fibro-adenoma. At one point near the periphery of the section two small islands of epithelium having the appearance of nests of cancer cells were found. Frozen sections were now made from various portions of the growth, all of these presenting the appearance of fibro-adenoma infiltrated in places by more or less numerous cancer cells (Figs. 1–5).

Diagnosis: Carcinoma originating within an adenofibroma.

The material received after the second operation consists of pectoral muscles and axillary contents. In the axillary fat, a single hard nodule, the size of a French pea, and several softer, atrophic lymph-nodes were found. Cut sections of the indurated node showed carcinomatous involvement.

This is an instance of a malignant growth in which the characters of the primary benign growth dominated the picture to such an extent that an error in gross diagnosis resulted. The case illustrates the danger of basing the diagnosis on transections of a portion of the tumor only, a common practice where a museum is being maintained. As stated above, the original transections did not pass through the region showing an invasion of the growth into the surrounding structure. It furthermore illustrated that a single section made from a tumor of this size may lead to error in diagnosis, even though a microscopic examination is made. If the first frozen section that was prepared had been only a few mm. shorter, the case would have passed as a benign fibro-adenoma. The advanced age of the patient in this case would naturally suggest a more extensive examination of the tumor.

Dr. Willy Meyer thought that these cases were not so very infrequent. He recalled one similar to that presented by Dr. Pool where all the evidence pointed to an ordinary adenofibroma, but which even-

tually in one place proved to be one of carcinoma. Such instances only emphasized the importance of careful and *thorough* work on the part of the pathologist in every case of this type, Of course, in his patient the radical operation was promptly carried out at a second sitting.

Dr. Frederic Kammerer mentioned a case illustrating the difficulties in the clinical diagnosis of mammary tumors. The patient was an unmarried woman of thirty, upon whom he had operated eleven years ago for a small tumor that presented all the clinical symptoms of a benign adenofibroma. The tumor was encapsulated and easily shelled out. The pathologist reported that parts of the tumor gave the impression of a rather malignant round-cell sarcoma. Half a year later a second similar growth was removed from another part of the same breast, which proved to be a benign adenofibroma. After another six months the entire breast was converted into an even, hard, painless mass. It was removed, the axilla being opened at the operation, and no infiltrated lymph-nodes found. In the further course of the case various recurrences in the scar were observed and removed, and these were submitted to three of our best known pathologists at different times, who all pronounced the growths rapidly growing, very malignant sarcomata. Finally, the case was turned over to Dr. Wm. B. Coley for treatment with mixed toxins who, after three months, did not believe that the patient had been materially benefited. Local recurrences had again appeared in and about the cicatrix and were growing rapidly. One more extended removal was attempted two months after the toxin treatment had been abandoned. The patient had remained well since (eight years): she was married about six years ago and has had one healthy child.

Dr. Pool, in closing, thought that Dr. Meyer's experience in regard to the frequency of this condition was unusual. He had discussed the case with three of the ablest pathologists in the city, and although they had seen cases in which the two lesions—adenofibroma and carcinoma—were associated in the same breast, none of them had ever seen a case in which there was evidence, as in this instance, of a carcinoma which had originated in an adenofibroma.

## PIGMENTED ODONTOMA OF THE UPPER JAW

Dr. A. V. Moschcowitz presented an infant, four and a half months old, born in the United States, of Italian parentage. When the child was six weeks old, the mother noticed a swelling of the right jaw: this gradually increased in size, but did not interfere materially with nursing. The child was taken to the Out-Patient Department of the Cornell Medi-

cal College, where two incisions were made into the growth with apparently negative result, and subsequently the family physician extracted a rudimentary tooth that presented itself in one of the incisions.

When Dr. Moschcowitz saw the baby for the first time, two months ago, there was a swelling of the right upper maxilla which involved the entire palatal surface and encroached upon the body of the jaw, so that the tumor was not only palpable but also readily visible. Roughly estimated, the swelling was about the size of a large English walnut and bled profusely upon the slightest touch from the granulations covering the previously made incisions. A specimen was removed and submitted to Dr. F. S. Mandlebaum for microscopic examination and was pronounced a pigmented odontoma.

The speaker said it was his first intention to extirpate the tumor; however, he gladly accepted the advice of Dr. Howard Lilienthal, who saw the case, to first try the effect of intensive X-ray treatment. Dr. S. Stern kindly consented to give these treatments, and had thus far made seven exposures, and as a result he was of the opinion that the growth had remained stationary. Personally, Dr. Moschcowitz said, he was of the opinion that the growth was larger now than it was two months ago.

Odontomata, the speaker said, were exceedingly rare, and still more rarely recognized. An excellent description of this type of tumor was given by Broca, who gave two varieties: first, the hard or crown odontomata, made up mostly of the cement or dentine substance; and, second, the soft odontomata, composed chiefly of pulp substance or periodontium.

The case was shown on account of its rarity and also to obtain an expression of opinion regarding treatment. Personally, in spite of the unfavorable outlook on account of the magnitude of the indicated operation, the speaker said he was inclined to attempt a radical removal.

Dr. Howard Lilienthal said that when he first saw this child, about two months ago, through the courtesy of Dr. Moschcowitz, he did not believe it was in a condition to survive a radical operation, and for that reason he advised a trial of the intensive X-ray treatment, which had evidently not had much effect. Now there appeared nothing else to do but to either excise it or to try the method of Bloodgood and burn it out with a powerful electrocautery. The former was perhaps preferable in this particular case, as the growth was not of an extremely malignant type. An operation was pretty dangerous, in any event.

Dr. Arpad G. Gerster, who had also seen the case about two months ago, thought there had been a considerable increase in the size of the tumor since that time. He then looked upon it as a malignant

tumor and expressed the opinion that the only thing to do was to take it out, the sooner the better. Personally, he did not believe that the use of the thermocautery was less dangerous than the knife, and it gave no more security against hemorrhage, either at the time of the operation or afterwards. In using the thermocautery, in order to prevent adhesions between the eschar and the instrument, the latter must be kept in constant motion, for if we allowed it to rest for even a moment it became adherent to the baked tissue, and upon its withdrawal a severe hemorrhage was apt to follow. For that reason he considered it less dangerous to do a cutting operation, done as rapidly as possible, the object being to save blood by the rapid removal of the mass, and by packing and compression.

As to the prognosis in a case of this kind, Dr. Gerster said that was an entirely different matter. We knew that young children bore hemorrhage very badly, and he could recall cases where the loss of scarcely two drachms of blood after a circumcision gave rise to serious symptoms. In any event, an operation in a case like that shown by Dr. Moschcowitz was very hazardous, but was the only measure that promised a however uncertain result.

Dr. William A. Downes agreed with the previous speakers that an excision of the growth was indicated, and he thought that the preliminary ligation of the external carotid might be a wise procedure. In a discussion on the subject of the preliminary ligation of the external carotid in operations about the head and face at a meeting of this Society some years ago, the consensus of opinion seemed to be that the measure was not of much value; still it might be advisable in such a young child, where bleeding was such an important factor.

## STRANGULATED FEMORAL HERNIA: SAC CONTAINING APPENDIX ONLY

Dr. William A. Downes presented a patient and showed the specimen. The patient was an unmarried woman, twenty-eight years old, a seamstress, who for the past four and one-half years had noticed a lump in the right groin which would make its appearance about once each month, and after remaining for a day or two would disappear spontaneously. Upon such occasions it was very painful, but never gave rise to any other symptoms, such as fever, chills or vomiting.

On November 1, 1914, the lump in the groin appeared as usual, without apparent cause. It was very painful and failed to disappear, as on former occasions. When the patient was admitted to St. Luke's Hospital, on November 6, the tumor and pain were the only symptoms

complained of: there had been no fever nor vomiting, and the patient had been able to be up and about. The high operation for femoral hernia was performed—upon opening the peritoneal cavity the cæcum presented and it was found that the appendix passed under Poupart's ligament—only about one-half inch coming into view. No effort was made to draw the appendix through the femoral opening. It was divided at the base and the stump invaginated—neck of sac completely divided and ligated. Intact sac with appendix removed from below. Hardened sac opened ten days later showed distal one-half of appendix completely gangrenous.

Dr. Gerster said that many years ago, in the early eighties, he saw a woman, about forty-two years old, who for some time had had an inguinal hernia for which she wore a truss. One day the truss broke, and as she felt no inconvenience, she got along for a time without it. The hernia gradually increased in size and finally became painful, with symptoms of incarceration and strangulation, with persistent vomiting and fever. When Dr. Gerster saw her he diagnosed a strangulated hernia and sent her to the German Hospital. Upon opening the hernial sac, about six ounces of pus escaped, and within the sac was seen a portion of the cæcum and the appendix, which was perforated, with a fish-bone protruding through the perforation. The perforated appendix had apparently given rise to local intrasaccular peritonitis, with œdema and strangulation of the section of gut within the hernial sac. This case, the speaker said, occurred long before the question of appendicitis became well understood through the labors of Fitz, Sands and McBurney, and as there were no established rules as to how to deal with the appendix, he simply ligated it, liberated the strangulated gut and closed the wound, with drainage. This soon relieved her acute symptoms and eventually the patient made a perfect recovery. Of course, she retained her hernia.

Dr. Gerster said he subsequently learned that this patient had been eating codfish, and he still had in his possession a portion of one of the ribs of the fish that had caused the perforation.

Dr. Franz Torek said he had found the appendix in the sac of a left inguinal hernia.

Dr. Lilienthal said that he had seen a case of congenital hernia, strangulated, in a three-weeks-old child that was born six weeks before its time. On operation, the hernial sac contained the appendix, which was strangulated and gangrenous at its distal part. It was tied off and put back, and the wound packed with gauze. The patient made a good

recovery. An interesting finding in the case was that although this child was breast fed and only three weeks old, the colon bacillus was found in the appendix at that early date.

## THE OPERATIVE TREATMENT OF CARCINOMA OF THE ŒSOPHAGUS

Dr. Franz Torek read a paper with the above title, for which see April issue of Annals of Surgery.

Dr. Willy Meyer said that Dr. Torek's successful case of resection of the thoracic portion of the œsophagus was a source of pride and satisfaction to American surgeons. With the patient in such excellent condition in which she was shown here to-night, the case might well be looked upon as promising to become a permanent cure, all the more as the tumor proved to be a squamous-celled epithelioma, the most benign of all types of cancer in the gastro-intestinal tract, if we might stretch the latter to include the œsophagus.

The progress that had been made in resection of the œsophagus for carcinoma within the past two years was remarkable. The definite recognition of the fact that it was best for the patient to have the proximal stump of the œsophagus transposed, from the posterior mediastinum antethoracically under the skin downward, had proven the most important factor in this progress. This transposition was almost simultaneously done by Ach and Rehn, Jr., abroad, and Torek in this country. The tumor was approached in one of two ways, *i.e.*, either transpleurally or retropleurally. In this country the former route was favored, while Ach and Rehn preferred to work in the posterior mediastinum without opening the pleural sacs. It was to be hoped that the latter authors would take up this work again after the war had come to a close, so that we might have a chance of drawing comparisons. The question was an important one and should be settled.

The second important point we had learned was the proper selection of the cases for radical work. This could often only be determined in the course of the operation. Extensive infiltrating carcinomas which had caused symptoms of stricture for many months and covered a large portion of the tube should not be attacked radically if situated entirely, or in part, behind the aortic arch. The nerve centres could often not withstand the unavoidably severe interference with both pneumogastric nerves and their branches to the sympathetic system running to heart and lungs. However, here a palliative operation might still be done if the patient's condition permitted. Just as we were doing gastro-enterostomy in cases of inoperable stricture of the pylorus, so the

œsophagus might be divided above the upper end of the tumor, the distal end safely inverted and the proximal end brought in front of the thorax. The patient would then again be able to swallow, and thus his most ardent wish would be fulfilled. He should be left under the impression that the planned radical work was done, the relatives being made acquainted with the true facts.

The Beck Jianu method of combining inferior œsophagoplasty with gastrostomy was an excellent procedure, and the speaker said he had done this in six cases, with six recoveries. In the last case the tip of the new œsophagus reached up to the clavicle. In the case shown by Dr. Torek, the lower end of the proximal stump reached down to the second rib. If, in a similarly favorable case, the Beck-Jianu operation were done primarily, total œsophagoplasty could be incidentally accomplished.

The third point which bids fair to be of great help in improving the results of the operation was the addition of drainage. To emphasize this, Dr. Meyer cited the case of a man sixty-five years old, who was operated on by him in March, 1914, for a cancerous stricture of the œsophagus. A resection was done and the man stood the operation well, but succumbed to an infectious pleurisy seven days later, in spite of *subsequent* drainage. In this case the thorax was sealed hermetically at the time of the original operation, and if drainage had been employed at that time, his chances of recovery would have been greatly enhanced. The speaker thought that drainage should be added in every case where the lumen of the œsophagus was exposed in the course of the operation. That a patient after œsophageal resection recovered when the thorax was completely closed would be exceptional, and the evacuation of an infected pleural effusion subsequently might often prove too late in debilitated patients. In his service at the German Hospital, these patients were left under differential pressure for from twelve to fifteen hours in order to avoid a post-operative acute pneumothorax. Where this could not be done, a Tiegel drain might well be used. No doubt other methods would be devised for this purpose in the future.

Of course, early diagnosis followed by early operation was the desideratum for greater success in resections of the œsophagus for carcinoma, and it was to be hoped that radiography would prove of particular assistance in accomplishing this end. Drs. William H. Stewart of this city and Hessel of Germany were working successfully along these lines. They had the patient swallow a casing sealed at its distal end, which, after having passed the stricture, was filled with bismuth paste, and irregularities of the œsophageal wall could thus be

made out at an early stage. But of more importance still, for further progress in this field of surgery, was the aid of the general practitioner, to whom, naturally, these patients first applied for aid. If a patient who complained of difficulty in swallowing were promptly sent to a hospital in order to have the diagnosis established without delay, the chances of a successful operation would be immeasurably greater.

Dr. N. W. Green said that when he and Dr. H. H. Janeway were working on this subject it was their experience that this operation, especially the resection of the whole œsophagus, had been a very fatal one as carried out in the laboratory upon dogs. He thought that Dr. Torek gave the key-note of his success when he spoke of the importance of earlier diagnosis and operation on these patients. In one case that had come under his observation the tumor was situated at the bifurcation of the bronchi. It proved to be an epithelioma of the œsophagus and finally perforated into the bronchi, the patient dying of a septic pneumonia. No metastases were observed. Metastases from these growths appear to form rather late.

Dr. Moschcowitz thought that carcinoma of the œsophagus was decidedly on the increase. Scarcely a week passed that such a case did not fall under his observation, and always, unfortunately, in an inoperable stage, so that only a gastrostomy was allowable. There was one case under his observation, however, where he hoped to do a resection of the œsophagus in its cervical portion.

Dr. Kammerer said he had made one attempt to remove a cancer of the œsophagus lying behind the arch of the aorta through the thoracotomy incision advocated by Dr. Torek. After ligation of some of the intercostal vessels the aorta was sufficiently mobilized to expose the growth and to permit its removal, but it was soon seen that both vagi were involved, and the attempt was, therefore, abandoned. The patient collapsed and died rather suddenly on the third day. The speaker believed—to judge from what he had witnessed at the hands of other surgeons—that these so-called exploratory thoracotomies for cancer of the œsophagus were followed by a very high mortality, especially where an attempt had been made to remove the tumor. Sauerbruch recommended a small intercostal incision, through which the hand of the operator could be introduced and the operability of the tumor determined, and Dr. Meyer had spoken this evening of the possibility of improvement in the X-ray examination of tumors of the œsophagus, but from what the speaker had seen he was compelled to conclude that most surgeons—at least up to the present moment—needed a thorough exposure of the growth to determine whether it could be removed or

not. It was to be hoped that this high mortality could be reduced, but the outlook at the present time was not very encouraging.

Dr. Torek, in closing, took up the question of drainage, and said that the operation should be planned in such a manner that drainage would be unnecessary. By checking all hemorrhage and mastering all possible sources of infection the necessity for drainage was set aside. In fact, the presence of a drain would expose the patient to subsequent infection. If, on the other hand, through some accident, the surgeon was unable to leave the wound clean and dry, drainage was indicated, but it should be avoided, if possible.

As to the X-ray as a diagnostic aid, the speaker said he did not think it could tell us whether the tumor was inoperable or not. It gave no exact information in regard to metastases, nor did it tell us whether the growth was still confined to the œsophagus or had already involved the connective tissue or even the lung, except in far advanced cases. Only an exploratory operation would disclose these points. As to the value of a small incision for exploratory purposes, that, too, he regarded as unsatisfactory. The hand could not be introduced through a small incision in the thorax, and we could not learn in this way whether the tumor was operable or not.

## DIVERTICULUM OF THE ŒSOPHAGUS COMPLICATED BY ABSCESS OF THE LUNG

Dr. Franz Torek reported this case and showed the specimen. The patient, after having had a slight cough for some time, was taken sick rather suddenly with pain in the right side of the chest. There was slight dulness over a limited area. He developed a high fever, 104° and over, which, with occasional remissions, lasted many weeks. During this time he perspired freely and expectorated large amounts of fetid material, a mouthful at a time, the odor of which was sometimes absolutely unbearable. Elastic fibres were found in the expectorated material. He also gave a long-standing history of regurgitation of swallowed food which would occasionally become lodged over the larynx and give rise to cough, especially at night. With careful gargling, aided by pressure on the neck, he often succeeded in clearing out the food remnants.

With these symptoms and this history, the patient came under Dr. Torek's observation in the spring of 1914. The symptoms pointed to a diverticulum of the œsophagus and an abscess of the lung, probably with secondary gangrene. Bougies introduced into the œsophagus were halted at a point corresponding about to the upper thoracic aperture.

An X-ray picture of the lungs showed a shadow on the right side, about the middle of its lateral half. This shadow measured three inches from above down and three and a half inches across. The röntgenogram of the œsophagus showed the presence of a diverticulum, about an inch and a half in diameter, just below the cricoid cartilage. It was certain, therefore, that he had to deal with a diverticulum of the œsophagus complicated by abscess of the lung, the latter being doubtless caused by aspiration of foreign material which had been dislodged from the diverticulum. It was most likely that this occurred at night.

Naturally, these two conditions made a very unhappy combination, inasmuch as the presence of the fetid expectoration endangered the prospects of aseptic healing of the œsophagus after an operation on the diverticulum, and, on the other hand, the presence of the diverticulum led to a persistence of the danger of aspiration of foreign material into the lung, besides interfering with proper nutrition. Furthermore, the administration of ether or chloroform had to be considered seriously as introducing an element of danger in the presence of the pulmonary affection.

To meet these difficulties, it was planned, in the first place, to operate under local anæsthesia; and, second, to await a period of remission from the high fever for performing the operation. When the patient was kept perfectly quiet, the elevation of temperature remained moderate, but as soon as he was a little more active, a high fever would set in.

On May 5, 1914, Dr. Torek undertook the operation under anæsthesia with novocaine and suprarenin, one-half per cent. The deep injections, 15 c.c. or more, were made from the posterior border of the sternocleidomastoid muscle, whereas the region of the trachea, the sternothyroid, sternohyoid and platysma muscles and the subcutaneous connective tissue were injected from points at the anterior border of the sternocleidomastoid muscle. An incision was then made along the anterior border of the left sternocleidomastoid muscle from the hyoid bone to the clavicle through skin, platysma and superficial fascia. The sternocleidomastoid muscle was retracted laterally, and the sternohyoid mesially, while the omohyoid was divided. The middle layer of the deep cervical fascia, which also envelops the thyroid gland, was divided mesially to the carotid sheath. Now the thyroid gland, the larynx and the trachea were retracted, together with the sternothyroid and sternohyoid muscles, to one side, and the great vessels to the other, together with the sternocleidomastoid muscle, and the inferior thyroid artery was divided where it crossed the œsophagus. The

diverticulum, which took its origin from the posterior wall of the œsophagus, was then exposed, grasped with a blunt forceps, and thoroughly freed up to its neck by blunt dissection. The introduction of a bougie to aid in its identification was not necessary. The neck of the sac being large, it was not tied before ablation, as was done in the case of small-sized necks, but it was cut off and sutured in two layers, fine silk being employed.

The anæsthesia was very satisfactory. The patient, who was himself a surgeon, described his sensations very accurately. He felt pain only on two occasions: the first was at one of the deepest injections, when the point of the needle must have struck a nerve; the second was at a time when the diverticulum was tugged at rather forcibly. The anæmia produced by the suprarenin was a rather welcome concomitant of the method of operating under local anæsthesia.

Recovery was entirely uneventful. For two days, food was given per rectum only. On the third day water was given by mouth; then fluid food up to the twelfth day; after that soft food was allowed. An œsophageal tube was not employed for introducing the food. Inasmuch as the patient was very careful and fully appreciated the importance of taking only small quantities at a time in order to avoid stretching the œsophagus and thus endangering the integrity of the suture, he was permitted to swallow early. In fact, in this case, considering the existence of a focus of infection in the lung abscess, the oft-repeated washing of the œsophagus by a small swallow of some sterile fluid was believed to be rather advantageous.

The most interesting feature in this case was the subsequent behavior of the lung abscess. As soon as the aspiration of foreign material from the diverticulum had been checked by the removal of that sac, the lung abscess began to take care of itself. The cough gradually subsided and the expectoration became insignificant. In a röntgenogram taken as early as two weeks after the operation, the shadow area in the lung was seen to have diminished in size and to have become much fainter. No further X-ray pictures were taken, but the patient had entirely recovered and was now actively attending to his practice.

Dr. Kammerer said he had operated on a case of diverticulum somewhat similar to Dr. Torek's case a year and a half ago. X-ray examination alone had revealed the true nature of the trouble after prolonged and repeated attempts to introduce various sounds into the stomach had absolutely failed. Even Plummer's sounds, passed over a silk thread, would not enter beyond the diverticulum, though traction upon the thread raised the sound out of the pocket behind the œsopha-

gus. The neck of the sac was rather small and was easily ligated at operation, this ligature being reënforced by a row of sutures. There was no leakage. A soft rubber tube could be easily passed into the stomach after the diverticulum had been removed.

Dr. Moschcowitz said his experience with drainage in operating upon the œsophagus had been very unsatisfactory, as the use of a tampon was invariably followed by leakage. More recently, he had discarded all drainage excepting the insertion of a small rubber dam, and his results had been better.

Dr. Edwin Beer said he had seen three cases of diverticulum of the œsophagus, and in every instance the X-ray picture was absolutely characteristic; in fact, the diagnosis was based upon it in every one of these cases. In the first case no instrument could be introduced into the œsophagus except under general anæsthesia; and the closure was attributed to a spastic spinal cord condition analogous to a similar urethral condition observed in the same patient. The X-ray cleared up the diagnosis. The second case was diagnosed as one of carcinoma of the œsophagus and a gastrostomy was done. The patient came to him fourteen months later, and the X-ray showed a typical diverticulum. In the third case, which was seen quite recently, the diagnosis was also established by the X-ray.

# TRANSACTIONS
OF THE
# PHILADELPHIA ACADEMY OF SURGERY

*Stated Meeting, November 2, 1914.*

The President, Dr. John H. Gibbon, in the Chair.

## SARCOMA OF THE TONSIL TREATED WITH RADIUM

Dr. Nathaniel Ginsburg presented a man, forty-nine years of age, who was brought before the Academy of Surgery a month ago with a tumor of the right side of the pharynx. The condition had been diagnosed as an inoperable malignant tumor of the right tonsil. The case was apparently hopeless from the stand-point of further surgery and the patient was sent to Dr. Newcomet for the use of radium. The entire right side of the throat was filled by a mass which has now entirely disappeared.

Dr. John B. Roberts said that he wished Dr. Ginsburg could tell what the clinical characteristics of really malignant tumors of the tonsil are. There is difficulty in recognizing them with certainty. Three or four years ago a man in his ward at the Methodist Hospital said to him, "You don't recognize me, do you, Doctor? I am the man from whose throat you took the cancer of the tonsil." He then recollected that about ten years before he had operated upon him for malignant disease of the left tonsil. He supposed he was dead long ago. He had sawed his jaw apart, after chloroforming him by means of a tube passed through a tracheal incision, and took out the tonsillar growth and also a portion of the soft palate. No radium was applied and no X-ray. It was before we were familiar with radium and probably before the X-ray was used to any extent. Yet here was a man who lived something like ten years with no return of what was pronounced, by the pathologist making the microscopical examination, a malignant tumor. The man was sent to Dr. Walter Roberts, who could find nothing wrong, except a cicatricial condition where about ten years before there had been this mass. There is something peculiar about these tonsillar growths which is not understood and which the pathologists do not recognize as to the histological structure. Some years previously Dr. Roberts saw a tonsillar growth, which had been diagnosticated by a renowned laryngologist as a malignant tumor. The family physician and the speaker believed it to be syphilitic. This, active treatment proved to be the true diagnosis.

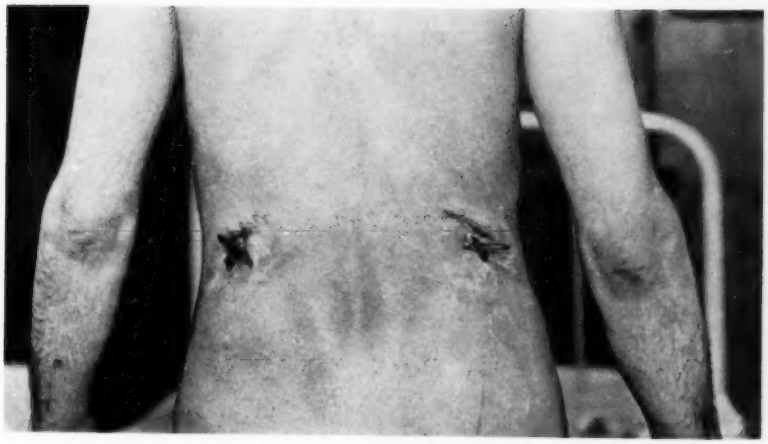


FIG. 1.—Bilateral nephrostomy, drains emerging in each lumbar region.

FIG. 2.—Tubes attached to carry urine to receptacle in front.

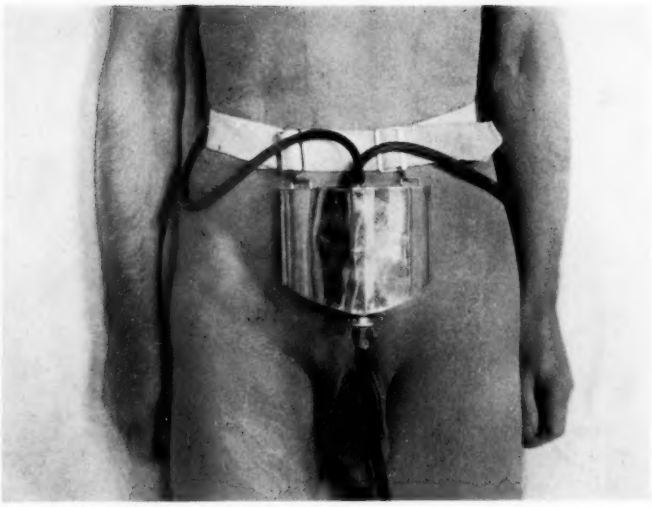


FIG. 3.—Nephrostomy. Urinary receptacle in front above pubis receiving tubes coming from drains emerging behind.

## DRAINAGE AFTER NEPHROSTOMY

DR. B. A. THOMAS presented a patient who had had two nephrostomies. One side was operated upon in last January; the other in February. The Watson apparatus did not work satisfactorily in this case. After taking the course of the fistula, he then devised two sterling silver drains to which tubes were attached to convey the urine around in front to a receptacle. The photographs (Figs. 1, 2 and 3) show the patient before and after the use of the Watson apparatus and also with the silver drains inserted. Inside the silver drains have bulbous extensions which prevent their displacement, also external flanges which prevent them from going in too far. It has been almost a year since the operations were done. The man has multiple recurrent polypi of the bladder and has been coming to the dispensary every other day for several months for dressings. In taking the drains out last week for washing and removal of contained phosphatic deposits considerable pain was caused. The man has gained ten pounds in weight since the operation, is in much better condition than before his nephrostomies, and insists upon his third promised operation—a cystectomy, which will be performed in a few days.

## THE SURGICAL ANATOMY OF THE UPPER AND LOWER POLES OF THE THYROID GLAND WITH REFERENCE TO THYROIDECTOMY

DR. NATHANIEL GINSBURG read a paper with the above title, for which see page 268.

DR. A. P. C. ASHHURST said that several years ago as a result of elaborate experiments Delore and Alamartine pointed out that the circulation of the thyroid is much freer between the upper and lower poles of each lobe than across the midline. On this account they advised ligation of the superior and inferior arteries on the same side instead of both superiors, as had been done usually before. They also urged ligation of the inferior artery near its origin, exposing it by incision on the outer side of the sternocleidomastoid muscle. Dr. Halsted recently also has come to the conclusion that the inferior artery is best ligated, not close to the gland, but somewhere nearer its origin.

## THE PREVENTION OF POST-OPERATIVE INTRAPERITONEAL ADHESIONS

DR. R. H. CHANEY read a paper with the above title, for which see page 297.

DR. GEORGE G. ROSS said that it seemed to him very evident that the formation of adhesions is a beneficent act of Nature to prevent the spread of infection, and that prevention of adhesions is not always

an advantage to the individual. The excess of adhesions is a different problem, and a most serious one in surgery. When adhesions become a menace to the patient by causing obstruction, changing the position of, or interfering with, the mobility of organs and by recurring after being broken up, they form a problem which is still unsolved, and one of vast importance. The paper, however, does not seem to throw any light upon the immediate solution of this problem. I should like to ask how we may prevent this type of adhesions.

DR. A. BRUCE GILL called attention to another class of cases in which intestinal adhesions occur that may lead to the death of the patient. When a general peritonitis follows the rupture of a gastric or duodenal ulcer, adhesions are formed between the loops of gut and between the gut and the parietal peritoneum. Thus localized collections of pus are formed that are not drained by gravity. Such collections may be found beneath the spleen while the patient has been kept in the sitting posture and suprapubic drainage maintained. Death occurs from absorption from these peritoneal abscesses that are undrained. The problem seems to be to prevent the formation of such collections of pus by preventing peritoneal adhesions during the acute stage of general peritonitis. With this object in view, in his last case of ruptured duodenal ulcer with evidence of general peritonitis he flushed out the peritoneal cavity with a solution of sodium citrate, 1 per cent., and sodium chloride, 2 per cent., at the time of operation; and proposed to repeat this procedure at intervals by pouring the solution into the upper abdominal wound and allowing it to escape from the suprapubic wound. However, the patient was in such degree of shock on his admission to the hospital that he died an hour after the operation was completed.

It seemed to him that the objections to the use of citrate solution mentioned by Dr. Sweet do not hold in cases of general peritonitis, where free drainage is essential to the recovery of the patient and where adhesions prevent such drainage in spite of the force of gravity.

If the closure of the perforation in the gut should be delayed by the presence of the citrate, this would not be an insuperable difficulty.

DR. A. P. C. ASHHURST inquired whether Dr. Sweet employed a 3 per cent. solution of citrate in normal salt solution, or if he used the 2 per cent. solution of sodium citrate in a 3 per cent. (hypertonic) salt solution, as advised by Saxton Pope himself.

DR. CHANEY, in closing, said that they used the 3 per cent. citrate in normal saline because that was the solution used by Koch in his work upon rabbits and with which he found very satisfactory results.

## ARTERIOVENOUS ANEURISM OF THE FEMORAL ARTERY AND VEIN

Drs. Edward B. Hodge and J. E. Sweet reported the following case because of the relative infrequency of the condition present and the favorable result so far obtained by modern surgical methods.

C. M., aged twenty-nine years, was referred to the service of Dr. Hodge at the Presbyterian Hospital, May 19, 1914, by Dr. E. H. Goodman with the diagnosis of arteriovenous aneurism of the left femoral artery. In May, 1898, while cleaning a revolver, he accidentally shot himself, a .32-calibre bullet entering the inner side of the left thigh about its middle, and being later removed from beneath the skin on the outer aspect.

There was free bleeding, spurting to a height of 12 inches. He walked downstairs, fainted, and soon the hemorrhage ceased. With no ligatures and simply an occlusive dressing, the wound healed after two weeks in bed. A year later, he noticed a pea-sized lump at the point of entrance and also began to have a sensation in the leg described as "buzzing." Two years ago—14 years after the accident—the leg began to swell and in the last year this has increased markedly. With the enlargement has gone an increase in the "buzzing" sensation. The latter is noticed only at night and, with the marked pulsation and throbbing now present, keeps him awake. There is no actual pain or tenderness present.

The general physical examination by Dr. Goodman reveals nothing abnormal except a slight apical systolic murmur transmitted to the angle of the scapula.

The left thigh is somewhat full. From about 5 cm. above Poupart's ligament to the small scar at mid-thigh is an irregular, soft swelling following the line of the vessels. Over this swelling is noted a strong, expansile pulsation, a marked thrill and a loud to-and-fro murmur.

The latter is conducted well into the leg, being heard distinctly half way to the ankle. Pulsation is present in both tibials. The right thigh measures 42 cm.; the left 46 cm. The Wassermann was negative.

It seemed a good opportunity to have the benefit of the skill in vascular surgery possessed by Dr. J. E. Sweet, Professor of Experimental Surgery in the University of Pennsylvania. Dr. Sweet kindly saw the patient and, with Dr. Hodge's assistance, operated as described below. It is to be noted that at operation both artery and vein were found enlarged, the vein much more so. To the dilatation of the latter is to be ascribed the swelling of the thigh in the last two years finally involving the external iliac.

Convalescence was marked only by a rather higher temperature range than might be expected. There was aseptic healing. From the time of operation, the patient had no trouble with the leg, sleeping well. Pulsation, thrill and murmur were absent. On June 5, the left thigh measured only 0.5 cm. more than the right. When last observed, August 27, the patient felt perfectly comfortable and local conditions were as noted in June.

Dr. Sweet added that the choice of the method to be followed in an operation for arteriovenous aneurism will depend upon the peculiarities of the given case, and may indeed depend upon the condition there found after more or less extensive dissection on the operating table. In the present case a pulsating tumor existed, extending from a little below the scar of the traumatism at the middle of the thigh to well above Poupart's ligament. An extirpation could not be considered and the quadruple ligation of classic recommendation would have to be undertaken upon diseased vessel walls.

The only tenable suggestions were the separation of the vessels with sutures of the resultant longitudinal wounds, or simply closure of the connecting channel with no attempt at separation. There seemed to be no reason for the extended dilation of the vessels except the mechanical disturbance of the blood current; the patient was young, did not show any evidence of general arteriosclerosis, gave a negative history as to syphilis and alcohol. It was therefore argued that since no other explanation could be found for the enlargement of the vessels than the disturbed course of the blood stream, the correction of this disturbance would result in the healing, or at least marked reduction in size, of the enlarged vessels. After the vessels had been dissected out and the communicating channel found, a small clamp was applied to this channel (Fig. 4); the thrill immediately ceased and pulsation in the vein was no longer felt. The vessels were adherent for about 1½ inches. The actual communication appeared to be about ¾ inch in length.

The channel was permanently closed by a row of fine silk interrupted sutures, passed through and through at the side of the clamp, and the clamp was removed. This was done without attempting to control the blood current except by placing an Esmarch bandage in position to meet any possible accident. The last suture cut through at the upper angle and a slight hemorrhage occurred, which was controlled by proximal digital pressure and stopped by placing another suture. This incident emphasizes a point not made sufficiently clear, if even mentioned in the articles on aneurism, namely, the difficulty of suturing the walls of a diseased artery or vein. It is not difficult to obtain beautiful experi-

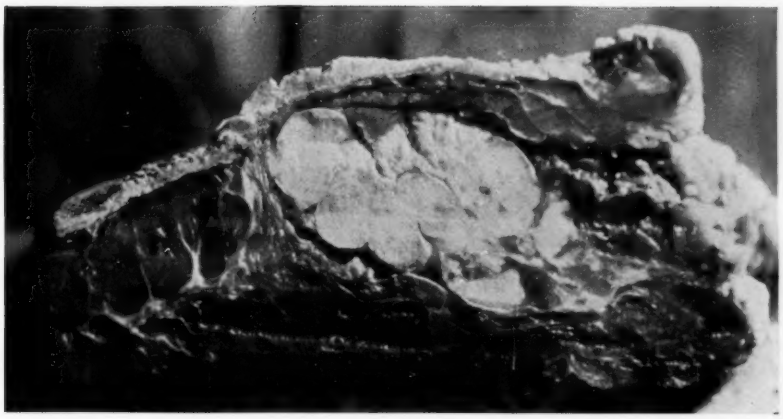


FIG. 1.—Transection of adenofibroma of breast with secondary development of carcinoma. The growth infiltrates adjacent tissues to slight extent at one point.

FIG. 2.—Frozen section in which masses of cancer cells were first found. *A*, masses of cancer cells; *B*, duct surrounded by area of round-cell infiltration. See higher magnification Figs. 3 and 4.

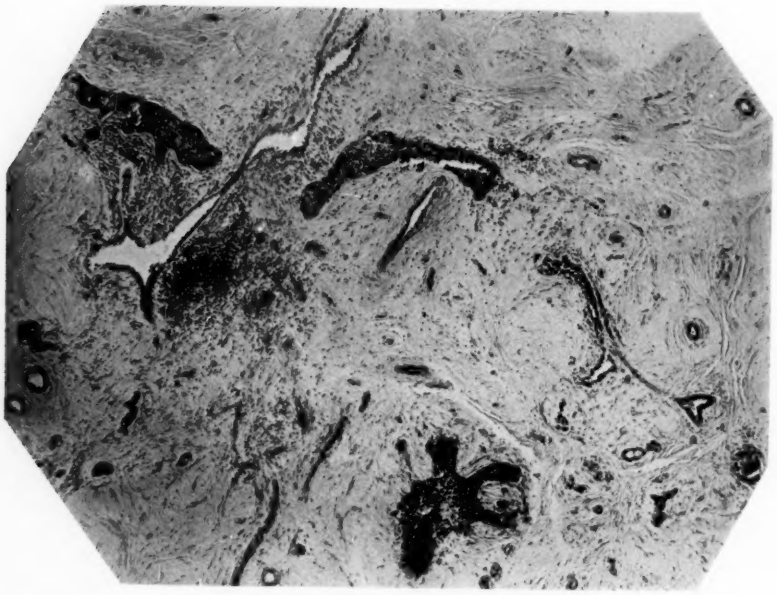


FIG. 3.—High power of *A* and *B* in Fig. 2.

FIG. 4.—Area of adenofibromatosis.

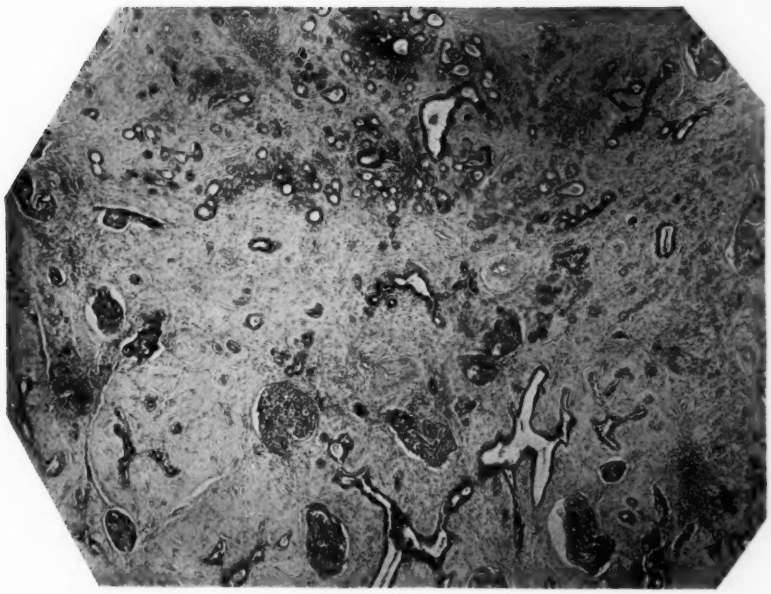


FIG. 5.—Showing large nests of cancer cells and islands of adenomatosis hyperplasia.

mental results on normal vessels; but it is positively dangerous to transfer these results to diseased blood-vessels. This tissue will not hold the fine sutures nor can it be depended upon to hold sutures for any length of time, even when the sutures may seem to be successful at first; secondary hemorrhages have often occurred.

These remarks do not necessarily apply to the Matas method of dealing with a true aneurism, where layer after layer of sutures can be applied to the diseased vessel wall. Excision of the vessels and direct anastomosis of their ends might well be possible, and was indeed done by Murphy in 1897. The cases where this idea is practicable are rare, and the method can only succeed where the vessel walls are relatively normal, as they were in Murphy's case—a recent gun-shot injury. Lateral suture of the vessels is likewise not promising because of the friability of the vessel walls, except perhaps in a case in which a large sac existed between the vessels which could be pleated over the lateral sutures of the vessel walls.

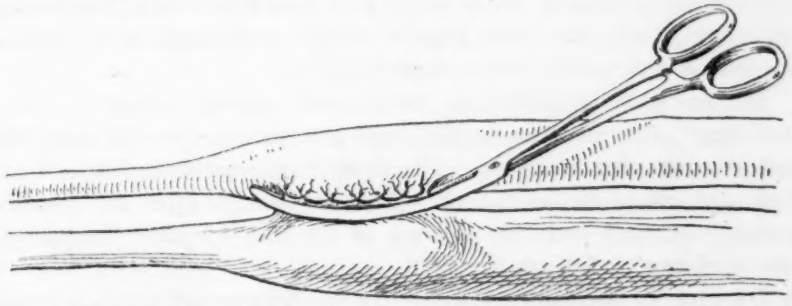


FIG. 4.—Clamp and suture of anastomotic ridge between artery and vein.

In this case the vessel sheaths and all the available surrounding tissue was brought over the vessels in several layers to bring pressure upon the vessels as far as exposed. Stewart, of New York, had succeeded in one case with a similar technic.

The order of choice of method to be decided for each individual case, perhaps not until the operation can disclose the exact relations of the vessels, is (1) the simple ligation of the connecting channel, if this be small enough to permit a closure by ligation, if not, its closure by one or more rows of sutures passed through both walls of the intercommunicating channel; (2) in the presence of a definite sac between the vessels, or as a part of one vessel, to restore the contour of the vessels by rows of sutures placed from the outside and plicating the sac over these sutures for support; (3) if the vessels show little evidence of disease, resection and end-to-end anastomosis, although this

type of case would probably be the most suitable for the method first described, and (4) as a measure of last resort, quadruple ligation.

Dr. Gwilym G. Davis said that he saw a case some years ago in a child in which, while a physician was doing a circumcision, a movement of the child threw the knife on the thigh, puncturing the vessels. Subsequently an arteriovenous aneurism occurred and he was brought to him at the age of nine or ten on account of marked difference in length of the two extremities. The leg in which the arteriovenous aneurism had occurred was much longer than the other. In other words, apparently the arteriovenous communication had increased the growth very much. Of course, when a person is in the period of growth, a difference in the nutrition of the two limbs would tend to make a difference in their length. Beyond the period of growth, however, it is not to be expected that there should not be any difference in length. It is interesting to know that the transference of arterial blood into venous channels has a marked effect on the growth of a limb. If this could be done at will it would be a desirable means of increasing the length of the shortened limb in certain cases, such as occur after hip disease and various other disabilities.

Dr. John B. Roberts said that it had seemed to him for many years that "arteriovenous fistule" was a better term for this condition than arteriovenous aneurism. His experience was limited to one case years ago, in which he had the whole leg slough after an operation done by the then ordinary method of arterial ligation. Amputation was necessary, and death occurred.

Dr. Hodge, in closing, said that the condition could very accurately be described by the term suggested by Dr. Roberts. The communication between the two vessels looked like a gastro-enterostomy opening. The opening was too large to ligate and the suggestion made by Dr. Sweet seemed to be the better method.

Dr. Sweet added that the two vessels which were uniformly enlarged were joined together toward the lower end of the enlargement by a channel about one and a half inches long. The vessels were dissected out until he could pass his finger behind the channel, and then the little clamp was placed as shown in the diagram; the pulse immediately returned in the arteries below the site of operation, even in the arteries of the foot. Then he made this closure permanent by inserting a row of interrupted sutures. From Dr. Davis's description of his case he inclined to the idea that one leg grew more than the other because of better blood supply, although he was not able to understand under the conditions how there would be a better blood supply.

## EGGSHELL FRACTURE OF HEAD OF METATARSAL

### SOME EXPERIMENTS ON THE SURGERY OF THE PANCREAS

DR. J. E. SWEET read a paper with the above title, for which see page 308.

### EGGSHELL FRACTURE OF HEAD OF METATARSAL

DR. PENN G. SKILLERN, JR., reported the case of a woman, aged forty years, who stubbed the second toe of her right foot against the floor. Clinical examination revealed swelling and "wincing" tenderness at the head of the second metatarsal bone. Skiagram (Fig. 5) revealed a loss of the normal convexity of the articular surface of the head of the second metatarsal bone, there being instead an irregularly flat surface with broadening of the head. The lateral view (Fig. 6) clearly reveals an oblique indentation, which resembles that of the proverbial egg of Columbus. There were no loose fragments. Treatment consisted in the application of a pad to the sole of the foot behind the head of the second metatarsal bone so as to keep the involved area clear of the ground, and thus free from the pressure of the body.

Dr. Skillern said that this is the seventh case of this injury on record. Freiberg (*Surg., Gynec., and Obstet.*, 1914, xix, 191) first called attention to the injury and reported six cases, all occurring in women. These patients had stubbed their toes in some manner, in two while playing tennis. They complained of pain in the ball of the foot in weight-bearing only. Freiberg suggests the following mechanism: "Under normal circumstances the second metatarsal bone is slightly longer than the first. In the presence of a diminished power of toe flexion, especially of the great toe, it is apparent that forcible impact against the ground of the ball of the foot, which is not sufficiently guarded by the flexor power of the toes, will cause the exposed distal end of the second metatarsal to bear the brunt of the blow."

The diagnosis must be made from metatarsal pain due to static weakness, and this is probably the reason why more cases have not been discovered. The rule is that in static weakness both feet are involved. Metatarsalgia or Morton's toe usually concerns the fourth metatarsal, and is paroxysmal in nature. There may be a history of having stubbed the toes. By reason of its close proximity it seems to the writer that fracture of the external sesamoid of the hallux must also be ruled out, but the mechanism of this injury is quite different.

The treatment consists in the use of a pad applied to the plantar surface of the foot by means of adhesive plaster, so that its anterior end is placed just back of the injured point. If there are loose bodies their removal by arthrotomy is necessary, unless few in number and very small.

It seemed to the reporter that the term "infraction" is undesirable. We are in reality dealing with an impacted fracture. In the mechanism and in the effect upon the oval head of the bone one is forcibly reminded of the proverbial manner in which Columbus solved the problem of making an egg stand on end, and for this reason, as well as the similarity of the compact layer of bone of which the periphery of the head is composed, he suggests the term "egg-shell fracture" as being more appropriate and descriptive.

## FRACTURE OF PROCESSUS POSTICUS TALI WITH FRACTURE OF CALCANEUM

DR. SKILLERN reported the case of a man, aged thirty-eight years, who fell in a tank, injuring his right foot, for which he was admitted to the University Hospital, service of Dr. Charles H. Frazier. Clinically, bony landmarks were obscured by great swelling, but there was "wincing" tenderness along the fore part of the calcaneum, a fracture of which was suspected. Skiagram (Fig. 7) revealed a comminuted fracture of the antero-inferior portion of the calcaneum. It also showed a fracture of the processus posticus of the astragalus, probably from the impact of the dorsum of the calcaneum. The usual treatment of fractures about the foot was instituted.

According to Stimson (*Fractures and Dislocations*, 7th ed., 1912, 459) fracture of processus posticus tali was first mentioned by Cloquet, in 1844. Lilienfeld (*Archiv. f. klin. Chir.*, 1905–1906, lxxviii, p. 945) says the combination of fracture of the calcaneum with fracture of the processus posticus tali, as in this case, is by no means rare, and that isolated fracture of the processus posticus tali occurs more frequently than is diagnosed. Of 600 fractures observed by him at the Zander-Institut, there were 7 isolated fractures of the processus posticus tali and 5 in conjunction with fracture of the calcaneum.

The cause of fracture of the processus posticus tali is a fall upon the heel with the foot in plantar flexion, thus impacting the calcaneum against the process. The clinical diagnosis is made by the history of the injury and localized tenderness elicited by deep pressure with the finger above the external attachment of the tendo achillis. There may also be a slight concavity of this tendon just above its insertion.

Stimson and others confuse fracture of the processus posticus tali with the inconstant os trigonum. Thus, Stimson quotes Lilienfeld as having observed 12 fractures of the os trigonum, whereas a refer-

FIG. 5.—Infraction (egg-shell fracture) of head of second metatarsal. Note flattening of articular surface, and compare with normal convexity at heads of uninjured metatarsals (antero-posterior view).

FIG. 6.—Lateral view of Fig. 5. Note oblique indentation.

FIG. 7.—Fracture of processus posticus tali with fracture of calcaneum. Note diminished density of that part of astragalus from which process is separated (lateral view).

FIG. 8.—Longitudinal fissured fracture of lower extremity of radius. Beginning at ridge on inferior articular surface between the quadrilateral and triangular facets the line extends obliquely upward and outward 4 cm., to disappear .5 cm. internal to outer border of radius.

ence to his article shows that it was the processus posticus tali that was fractured. The same error had been made in the case that I report.

The processus posticus tali is the posterolateral projection of the astragalus, the lateral tubercle of anatomists, which bounds externally the sulcus for the tendon of the flexor longus hallucis muscle.

The os trigonum, or intermedium cruris, on the other hand, lies in the second month of fetal life as an anlage of hyaline cartilage between the distal ends of the tibia and fibula, and has the shape of a triangle with the apex directed proximally and the base distally. Normally it remains independent for only a short time, uniting to the astragalus. In 3 per cent. of cases it persists as an independent bone. Aside from man it is found among mammals only in the wombat. When persisting it is always situated behind the astragalus, from which it is separated by a slight fissure, and is oval in form, measuring 20 by 15 mm. It is present on both sides, and has the peculiarity of being usually rudimentary on one side.

He had not been able to find an instance of fracture of the os trigonum. The question is whether the fragment found is a fractured processus posticus tali or a normal, though inconstant, os trigonum. A study of the skiagram shows a definite vertical plane of fracture, with diminished density of that part of the astragalus from which the processus posticus was broken off.

## LONGITUDINAL FISSURED FRACTURE OF LOWER EXTREMITY OF RADIUS

DR. SKILLERN presented a skiagram which he said was obtained in the Surgical Out-Patient Department of the University Hospital, but the patient did not report after visiting the Receiving Ward, probably because of slight symptoms, and therefore no history was obtained. It shows a fissure beginning at the ridge on the inferior articular surface of the radius between the quadrilateral and triangular facets and extending obliquely upward and outward 4 cm. to disappear 0.5 cm. internal to the outer border of the radius (Fig. 8).

This is the ninth case of the injury on record, if we wish to include that reported by Wilhoit (*Jour. A. M. A.*, 1913, lxi, 770) as a longitudinal fracture, but which in reality cuts off the ulnar corner of the radius. Writing in 1910, Cotton states: "So far as we know this fracture is the result of direct violence by crushing. It is very rare; three specimens constitute the total of the evidence." As in other longitudinal fractures it may be suspected clinically by a line of "wincing" tenderness.

## DISJUNCTION OF EPIPHYSES OF FOURTH AND FIFTH METACARPALS

DR. SKILLERN reported the case of a boy, aged fourteen years, who struck another lad with his right fist and reported at the Surgical Out-Patient Department of the Polyclinic Hospital on August 5, 1914. The heads of the fourth and fifth metacarpals were prominent on the dorsum, there were localized œdema and "wincing" tenderness. Skiagram (Fig. 9) shows separation of the epiphyses for these bones. Unfortunately a lateral view was not taken. Treatment consisted of reduction with immobilization by a straight palmar splint.

This injury is described by White in Piersol's Anatomy as follows: "Falls upon or striking with the closed fist tend to produce forward displacement. As the metacarpal bones of the index, middle, and ring fingers are the longer, their epiphyses are more likely to be separated in this manner. A fall on the extended fingers and metacarpophalangeal region may cause backward displacement, though this is rarer.

"The diagnosis from dislocation of the proximal phalanges is not easy. It is aided by the recognition of 'muffled crepitus' (Poland) and by the greater tendency of the deformity to recur, due partly to the small articular areas of the separated bones and partly to the action of the flexors and the interossei." Muffled crepitus was obtained in this case during the process of reduction. It was not sought as a diagnostic sign, because the diagnosis was made without this painful manipulation. The injury should not be overlooked, and reduction must be effected, lest the growth of the metacarpal be interfered with.

Coues (*Bost. M. and S. J.*, July, 1913) calls attention to epiphyseal disjunction at the base of the first metacarpal.

## INCONSTANT EXTRA-EPIPHYSIS AT BASE OF SECOND METACARPAL

DR. SKILLERN presented a skiagram (Fig. 10) which showed, in addition to the usual epiphysis at the head of the bone, an extra-epiphysis at the base, the centre of which is uniting with the shaft. The epiphysis may also be made out in the lateral view (Fig. 11). The writer's attention was called to this anomaly by Dr. H. K. Pancoast.

The first is the only metacarpal that has an epiphysis at its base normally, and for this reason it is considered by some as a phalanx, in which the epiphyses are always at the base. There is usually a scale-like epiphysis on the head of the first metacarpal, which makes its appearance about 8 or 10 and rapidly unites with the head. Rarely smaller epiphyses appear at the bases of the other metacarpals, as in

FIG. 9.—Disjunction of epiphyses of fourth and fifth metacarpals. Displacement shown at distal end of diaphyses.

FIG. 10.—Inconstant extra-epiphysis at base of second metacarpal. Union with diaphysis beginning at centre (anteroposterior view).

FIG. 11.—Lateral view of Fig. 10.

A

B

FIG. 12.—Case I

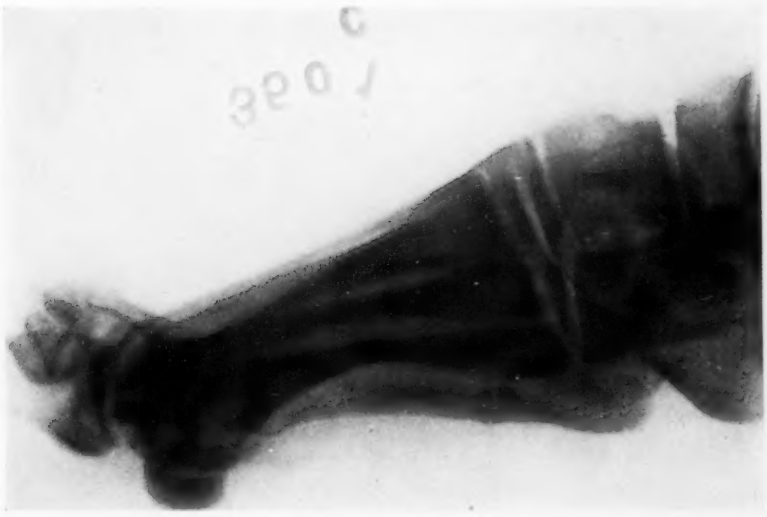


FIG. 13.—Case II.

mammals generally. There may be an independent centre for the styloid process at the base of the third metacarpal.

## FRACTURE OF BASE OF FIFTH METATARSAL

Dr. Morris Booth Miller presented skiagraphs of two patients with fracture of the base of the fifth metatarsal. In each the injury was due to indirect violence, the sudden imposition of the body weight while the foot was inverted and the heel raised. In this they are in accord with the cases previously reported by Robert Jones, Wharton, Coues, Cotton, Sylvester, and others, which show without exception that indirect stress is the responsible factor in all fractures of this type.

I. W. McC., aged twenty-five, while driving quickly stepped out of his carriage to avoid an accident. He stated that he was anxious to reach his horse's head and hence he was in the act of turning when his foot touched the ground. He felt a pain on the outer side of the foot but it was not severe and he was able to walk with very little discomfort. Diagnosis was by skiagraph which showed a fracture 3 cm. from the base. (Case I, Fig. 12, A and B.)

II. S. F., aged thirty-two, stepped from a ladder upon a hammer, which caused his foot to turn in, while at the same time he made a sudden effort to prevent a fall. Pain and partial disability caused him to seek hospital treatment. (Case II, Fig. 13.)

Dr. Penn G. Skillern, Jr., said the cause of this fracture by indirect violence is a sudden, sharp adduction of the foot, whether by dancing, jumping, or missing the last step of a ladder or staircase. Thus, the weight of the body comes down upon the outer border of the foot, turning the head of the metatarsal inward, and bringing a cross-strain to bear just in front of the broad basal portion of the bone, which is held firmly apposed to the similarly broad base of the fourth metatarsal by very strong ligaments. Near the front of the broad base the metatarsal gives way (Cotton). There may be a fissure of the outer side only or a clean break across. Pain is not great, and the immediate disability is only partial. By pressing the neck of the bone inward pain is caused at the base. "The alternative of fracture of the fifth metatarsal bone near its base by indirect violence is a luxation at its proximal articular surface, the avulsion showing as a distinct cleft in the skiagram."

The tuberosity at the base may be avulsed by the pull of the tendon of the peroneus brevis muscle. In 600 fractures Lilienfeld (*Archiv. f. klin. Chir.*, 1905–1906, 78, 929) found isolated fracture of the tuberosity but 5 times. This fracture must not be confused with the

presence of an *os vesalianum,* first described by Vesal. This is either an extratarsal bone of a persisting epiphysis situated at the proximal and external part of the tuberosity. It is a shell-like bone, marked off by a groove on the plantar surface. It is not present beyond puberty. Like the os trigonum, it is exceedingly rare, and occurs on both sides. Coues (*Bost. M. and S. J.,* May, 1914) reports a case in which the os vesalianum was present.

## BULLET LOCALIZER

Dr. David R. Bowen presented a new bullet localizer which he said, to be precise, was a new attachment to a localizer now in use.

The idea of using cross threads to replace the course of Röntgen rays and thus localize a foreign body originated with Mackenzie-Davidson of London.

Later, Mr. Edwin Kelly added the pointer rod which is now in general use.

Given a surgeon and a röntgenologist used to working as a team this has served well. Many, indeed very many, cases have arisen, however, in which, after the localization was made, the rod was found to point through an undesirable site for operation. The fact that this was usually due to faulty team work or inexperience in nowise lessened the annoyance. The device here exhibited aims to remove entirely the personal equation and to make the localization a matter of precision.

It is original, I believe, in that from a single Mackenzie-Davidson localization variations can be made at will without further röntgenization. It is also original in that an actual probe is a part of the apparatus.

The instrument consists of a series of aluminum bars joined together by thumb nuts so as to make a four-jointed bar, fifteen inches in length, capable of universal motion in a single plane. At one end is a clamp which fits the Kelly pointer rod, while the opposite end carries a tubular probe carrier.

To use, the clamp is fitted to the rod at a distance above a permanent mark on the rod equal to the distance of the F. B. below the end of the rod, as determined by the usual method. The joined bar is then adjusted so that the probe will just touch the end of the pointer rod.

It is obvious that if, now, the clamp is moved down to the mentioned permanent mark, then the probe will point directly at the foreign body; that an indicator attached to the probe will indicate the depth of the F. B. in that direction just as does the indicator on the Kelly pointer; and also that the direction of the pointer can be changed repeatedly at will (see Fig. 14, A and B).

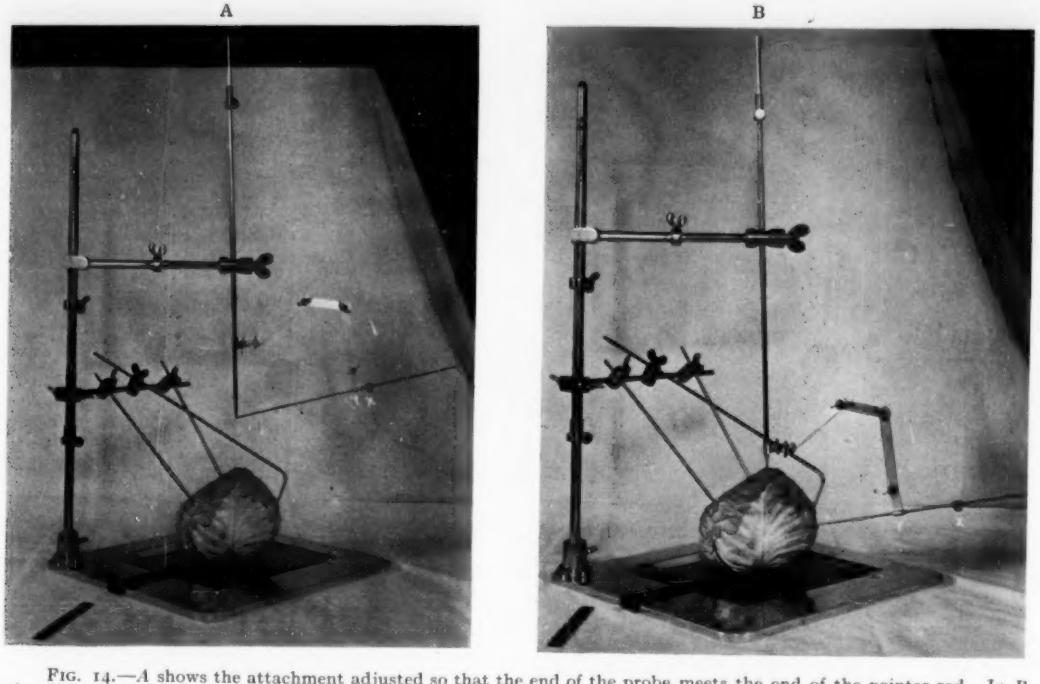



FIG. 14.—*A* shows the attachment adjusted so that the end of the probe meets the end of the pointer rod. In *B* the clamp has been lowered on the pointer rod the specified distance. *X* is the indicator on the probe; *Y*, the tubular carrier; *ll'* show the attachment complete. In *B* the distance between *X* and *Y* is the distance from the end of the probe to the foreign body.

# BOOK REVIEWS

DISEASES OF THE RECTUM AND COLON AND THEIR SURGICAL TREATMENT. By JEROME M. LYNCH, M.D. 8vo, pp. 583. Lea and Febiger, Philadelphia.

DISEASES OF THE RECTUM AND ANUS. Edited by A. B. COOK, A.M., M.D. F. A. Davis Co., Publishers. 8vo, 610 pages.

These two works on rectal diseases are dedicated to Mathews and Tuttle, whose teaching they honor, augment and perpetuate.

The volume by Lynch has extended its field from that of proctology to include diseases of the colon. Such an extension of scope without increase of text has been accomplished at the expense of detail and completeness.

In addition to the usual chapters entitled, Examination and Diagnosis, Hemorrhoids, Fistulæ and Fissures, there are several chapters that offer well arranged material of practical value to the reader. These cover the subjects of cryptitis, papillitis, diverticulitis and radiographic examination of the bowel. Particularly noteworthy is the contribution by Dr. Maxwell Telling of Leeds on the pathology and differential diagnosis of parasigmoid infections of diverticular origin. Frequent errors in mistaking these benign sigmoid infections for malignant neoplasms and the infrequency of their discussion in books on the rectum renders this reference of particular value.

The chapter on symptomatology and diagnosis of neoplasms of the colon includes all the cardinal subjective and objective findings that characterize a well-established lesion, but falls a little short, perhaps, in elucidating that early evidence upon the recognition of which so much of the success of operative relief surely depends. Scant attention is given systematic, intelligent palpation, inspection, auscultation and percussion of the abdomen, and none to the physical and chemical examination of fæces, or to disturbances in contiguous organs and tissue. One notes with pleasure, on pages 242–244, the recognition of the high enema fallacy and a means of overcoming this difficulty without the use of a long rectal tube and high pressure. The publisher's care and skill are recognized in attractive binding, clear typing and illustrations.

The volume, edited by A. B. Cook of Los Angeles, is composed of articles written by several authors, each recognizably competent

in the special field selected. The first 294 pages are by the editor himself, and cover the subjects of general diagnosis, examination, constipation, pruritus, proctitis, and ulcerative processes and infections, hemorrhoids and prolapse. Chapters on local anæsthesia and the relation of rectal diseases to general health offer suggestions of value in a progressive phase of proctology. Recto-colonic alimentation is still held up as scientific therapeutic procedure, despite recent testimony as to the physiological availability of food materials thus absorbed. Under the heading, Rectal Pathology Due to Extra Rectal Causes, no mention is made of chronic parasigmoid infections of diverticular origin.

WILLIAM C. WOOLSEY.

THE CANCER PROBLEM, by WILLIAM SEAMAN BAINBRIDGE, M.D., Professor of Surgery, New York Polyclinic Medical School and Hospital, etc. New York. The Macmillan Company, 1914. Octavo. 534 pages.

In this book the author has assembled from many sources data bearing upon the subject of cancer in such a way as to give a comprehensive résumé of present knowledge with reference to cancer. It is evidently intended to be a book of reference, not especially for the use of surgeons any more than for the use of the general practitioner or by the intelligent layman who is interested in health matters.

After a brief chapter detailing the development of the methods for cancer research that are being pursued both in this country and abroad, he passes on to a statement of facts with regard to the distribution of cancer, embracing its zoological, ethnological, and geographical relations.

The theories which have been advanced by various scientists as Virchow, Thiersch, Waldeyer, Cohnheim, Ribbert, Hauser and others are briefly stated, only to end in the rather discouraging conclusion, which is only too true, that all the theories that have been advanced are insufficient, and that the true or even a satisfactory working explanation of the nature of cancer has not yet been discovered, but that the outcome of all study to date has been simply to emphasize the importance of the removal of all possible sources of chronic irritation, and of benign neoplasms which are subjected to irritation in the effort to remove predisposing causes of cancer.

A full and well-illustrated chapter on the histopathology of carcinoma is given. Chapters follow devoted to the clinical course of cancer, diagnosis and possible errors in diagnosis.

A most important and interesting series of observations are con-

tained in Section IX which records the result of investigation upon modern cancer cures in which are detailed investigations as to the value of the enzyme treatment, of the use of serum from birds of prey, of "Cancroidin," of the Otto Schmidt Serum, of the toxins of the micrococcus neoformans (Doyen's Serum), Chian Turpentine, soap solution and ox-gall, molasses, violet leaves and various quack cures, etc., etc., the section ending as was to be expected with the statement that the examination of the many agents and methods which have been employed in the treatment of cancer leads only to a reiteration of the statement that, in the present state of knowledge, surgery offers the only dependable hope of cure.

Then follows a description of more modern resources for treating cancer, under the title of Physiotherapy, including in this class the Röntgen rays and radium, destructive fulguration and the various applications of the electrical current, in all of which the results in some cases had been sufficiently encouraging to warrant further work along the lines mentioned. The author sums up this part of his book by saying that the surgery of to-day offers to cancer patients a greater chance of recovery than ever before, and a degree of increased comfort when cure is no longer to be hoped for.

A general bibliography of the subject closes the volume together with a very full index, both of authors and of subjects.

The author has placed all surgeons under obligation to him for the manner in which he has brought together, within the covers of a book of moderate size, so much information upon a theme of which there is none of higher interest to surgeons nor to the human race.

LEWIS S. PILCHER.

# CORRESPONDENCE

## THE RED STIPPLING SIGN OF GASTRIC AND DUODENAL ULCER

To the Editor of the Annals of Surgery:

During the last seven years I have recognized the importance of this sign in the diagnosis of chronic ulcers at operation, and have demonstrated it in the operating theatre to generations of residents and dressers. I referred to it in print four years ago.[1]

In the article on Surgery of Stomach and Duodenum contributed to Choyce's *System of Surgery*, vol. ii, 1912, it will be found mentioned on the following pages: 344, 352, 365, 388.

It is one of the most characteristic signs and one on which I lay the greatest stress. It is often visible without the slightest stimulation, but in cases in which there is any doubt gentle rubbing with a gauze swab will cause it to become prominent. It is particularly well marked in a chronic duodenal ulcer situated on the first part of the anterior surface, and often surrounds the ulcerated area as a ring of red speckling.

James Sherren.

London, England, November 3, 1914.

To the Editor of the Annals of Surgery:

The red stippling sign of gastric and duodenal ulcer, described by Dr. Charles L. Scudder of Boston, Mass., in Annals of Surgery, October, 1914, page 534, I believe has some value and is probably present in a high percentage of cases. As a help to differentiate between ulcer and cancer, I cannot say of how much value it may be, as it had never been brought to my attention until Dr. Scudder's article came out in the Annals of Surgery.

Since reading Dr. Scudder's article I have been able to demonstrate the red stippling in three cases of ulcer, namely, two of the pylorus and one of the lesser curvature.

I realize that three cases are too few to form any definite conclusion, but I think they may help to bring out the point that Dr. Scudder

[1] Clinical Journal, October 26, 1910, p. 35.

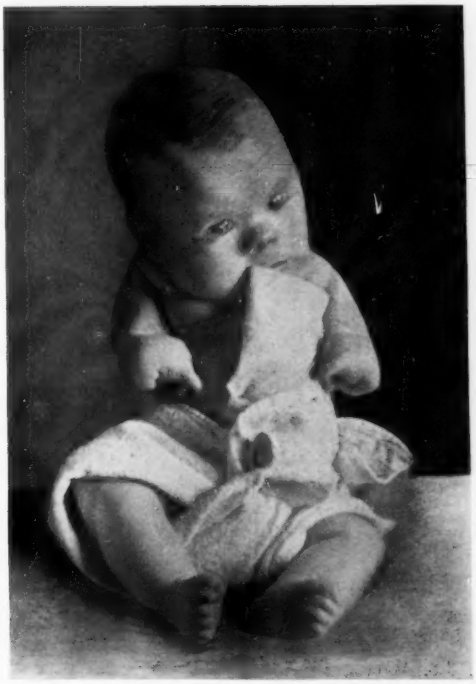


FIG. 1.—Bilateral congenital absence of the radius.

FIG. 2 —Skiagram showing bony condition present in Fig. 1.

wished to make. If we can prove this sign is usually present in ulcer and not present in cancer, it will be of unlimited value to help one to make a differential diagnosis at the time of operation.

HERBERT O. BENNER.

Framingham, Mass., November 12, 1914.

## BILATERAL CONGENITAL ABSENCE OF THE RADIUS

EDITOR ANNALS OF SURGERY:

THE following case of deformity of both forearms present since birth was referred to me recently by Dr. Wm. Burt, of Paris, Ont.

The patient is the fifth child of apparently healthy parents. The first child is healthy and perfectly normal. The second baby had a very similar deformity of both arms, and died of inanition (?), when seven weeks old. The third and fourth children are healthy.

*Present Condition.*—A fairly well nourished baby, with a papulo-squamous eruption on the skin of the face and neck and of the scalp. The upper arm on each side is normal. The hands appear as stubs to the outside of the elbow (Fig. 1). On palpation the ulna can be felt projecting downward from the elbow, along the inner side of the wrist, and impinging on the skin near the inner angle of the metacarpus.

The radiogram (Fig. 2) shows total absence of both radii, without any other congenital deformity. The metacarpal bones are perfect in number and development. The deformity is due to ***bilateral congenital absence of the radius.***

From the presence of a similar deformity in another child, of a typically syphilitic dermatitis, and of a distinct thickening of the cortical bone in the phalanges of the mother's hand, I am inclined to believe that congenital syphilis has had a causative influence.

Brantford, Canada. EDWARD REGINALD SECORD, M.D.

## STRANGULATED INGUINAL HERNIA CONTAINING CÆCUM AND APPENDIX

EDITOR OF ANNALS OF SURGERY:

As a contribution to the question of strangulated hernia containing the appendix vermiformis, suggested by the case presented by Dr. Downes at the meeting of the N. Y. Surgical Society, November 25, I desire to report the following case which was under my own observation.

The patient, a man forty-five years of age, was admitted to the Harlem Hospital on January 12, 1908. For twenty years there had

been present a right inguinal scrotal hernia, no effort to control which had been made. One week before admission this was contused by the stroke of an iron bar. Severe pain followed, which continued, and at the end of a week he began to vomit, although the bowels had moved every day with the aid of cathartics.

When admitted there was an elongated mass extending from the external abdominal ring on the right side to the bottom of the scrotum, which mass was irreducible, and for an area of two or three inches around the external ring there was marked tenderness. Incision exposed a sac greatly thickened from inflammation. When it was incised a large amount of pus escaped. Within the sac, after the escape of the pus, there was found to be present the cæcum with the appendix. The distal end of the appendix was in the abscess. The appendix was removed and the intestine returned after enlargement of the neck of the sac. The sac was amputated and the stump returned to the abdomen. The cord and testicle upon examination were found to be much inflamed and at a number of places gangrenous. They were removed. The usual operation for radical cure of hernia was then done, the wound being closed with one drain in the inguinal region and another in the scrotal. Although some suppuration followed in the scrotal portion of the wound, he was discharged well at the end of four weeks. Patient has been examined by me recently and still remains well. There is no hernia.

New York City, December 8, 1914. JOHN F. CONNORS, M.D.

## ENDOTHELIOMA OF THE INTERCAROTID BODY

EDITOR ANNALS OF SURGERY:

We desire to place on record the following case: A colored soldier of the United States Infantry, who had always been in good health without history of pulmonary or syphilitic disease, presented himself with a tumor on the left side of the neck, the presence of which had been known for over a year. It had been painless until within a few weeks. Now turning the head to the left produces pain in the tumor. Deglutition somewhat painful and difficult on account of the swelling in the left side of the neck. Tuberculin test was negative; luetin test was negative; urine was normal. He was a well-developed man without any evidence of anæmia, emaciation, syphilis or tuberculosis. The inguinal postcervical lymph-glands are palpable and small, movable and painless. Teeth in good condition; tonsils somewhat enlarged, not inflamed. In the left side of his neck in the upper portion of the anterior triangle is

a solid tumor the size of an egg, movable, slightly tender, slight non-expansive pulsation. When head is bent toward left shoulder, the tumor is pressed upon by the angle of the jaw, causing pain.

*Operation* (March 19, 1914).—Ether. Incision along anterior border of sternomastoid. External jugular vein presented in wound and was ligated. On opening fascia a small solid tumor, size of pigeon's egg—like a lymph-gland—was exposed. This was dissected free of its attachments to surrounding tissues and was found to be part of a larger tumor beneath. The smaller upper portion was removed and the tumor beneath was found to be bounded on two sides and below by a large pulsating vessel. This was found to be the bifurcation of the carotid artery, though it lay more superficially than normal—probably lifted up by growth of tumor which was closely attached to the walls of all three arteries. Tumor was of bluish color, very vascular, and with moderately firm capsule. Its appearance was that of a thyroid gland. Tumor removed from walls of arteries by sharp dissection. Hemorrhage quite free, especially from several points in walls of carotids. Clamps applied and left in place. Wound packed with gauze.

March 22, 1914: Clamps removed and wound sutured.

March 29, 1914: Sutures removed; primary union.

April 26, 1914: Returned to duty. Condition good.

September 25, 1914: No recurrence to date.

REPORT ON THE PATHOLOGICAL EXAMINATION OF INTERCAROTID TUMOR (BY CAPT. F. H. FOUCAR)

1. An irregularly oval piece of tissue, grayish-yellow in color, consistence firm, cut surface smooth and homogeneous. The dimensions were 2.5 by 1.3 by 3 cm. The weight 2.2 cm.

2. *Microscopical Examination.*—The capsule was thin and sent in a few trabeculæ, dividing the gland into lobules. The specimen was seen to consist mainly of strands of endothelial cells; the arrangement of these strands of cells varied in different parts of the tumor; those in the cortical part of the tumor were arranged more or less parallel to the surface; the subcortical strands were finer and arranged perpendicularly to the surface; in the medullary portion, the endothelial strands were arranged in irregularly anastomosing plexi.

3. The spaces between the columns of endothelial cells were occupied by the following structures: (*a*) stroma, (*b*) parenchyma, (*c*) blood-spaces.

4. *Stroma* consisted of very little fibrillated connective tissue, most of it being represented by branching polygonal cells with large vesicular nucleus and faintly staining cytoplasm; the branching processes of these plasma cells, joining with semiprocesses of neighboring cells, formed spaces, some of which contained red blood-cells.

5. *Parenchyma.*—Between many of the trabeculæ of endothelial cells were closely packed masses of small cells; these cells presented a small amount of deeply staining cytoplasm, and a relatively large, deeply staining, oval nucleus;

they were arranged in narrow, irregular masses between the strands of endothelial cells, with here and there a suggestion of alveolar arrangement.

6. *Blood-spaces.*—No well-formed blood-vessels were noted in the entire specimen sectioned; their places were taken by irregular channels, lined with endothelium, which in places was much thickened.

7. No giant-cells were noted; a few karyokinetic figures were noted in the cells of the parenchyma of the gland. The stain used was alum-hæmatoxylin-eosin.

8. *Diagnosis.*—Endothelioma arising from an intercarotid rest.

Honolulu, Hawaii, December, 1914.

L. J. Owen, M.D.,
Captain, Medical Corps, U. S. A.

---

**To Contributors and Subscribers:**

All contributions for Publication, Books for Review, and Exchanges should be sent to the Editorial Office, 145 Gates Ave., Brooklyn, N. Y.

Remittances for Subscriptions and Advertising and all business communications should be addressed to the

**ANNALS *of* SURGERY**
**227-231 S. 6th Street**
**Philadelphia, Penna.**